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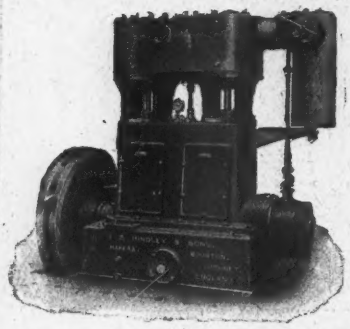

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THE

ELECTRICAL REVIEW.

VOL. LXXX. MAY 4, 1917. No. 2,058.

ELECTRICAL REVIEW.

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SALESMANSHIP AND ELECTRICITY SUPPLY.

THE efficient production and the successful disposal of electricity are two closely allied and mutually interdependent factors in all present-day electric supply work.

As regards the former, the supply authorities of this country have within the last year or two awakened to the fact that there is a much broader and more advantageous aspect of production than that usually associated with this branch of industry in the past, and this present-day appreciation of "what might be" has, as we know, found practical expression in the formation of the various linking-up committees throughout the country, with the direct sanction and co-operation of the Board of Trade, and, more important still, in the recently constituted departmental committee on Electric Supply, formed by the Board. The war has riveted the attention of industry on the utility of modern electrical methods, and the developments to which we have just referred are tangible steps towards the realisation of the ideal of electricity supply on national lines, as a fundamental basis of our national industrial prosperity and individual welfare; the question for us to consider is how far these steps are likely to carry us towards attaining our ideal.

To produce electricity efficiently is not a difficult matter given a suitable market for our wares, but to sell electricity as we want to sell it, *i.e.*, to provide the suitable market, is quite another problem, and one, moreover, in regard to which the electricity supply industry as a whole has as yet taken no adequate step of any kind. In saying this we have not overlooked the puny efforts of local sales organisations, or the occasional attempts at publicity by individual engineers—efforts which are, of course, praiseworthy in themselves, but yet are of such a desultory character as to have no appreciable effect in moulding public opinion in the mass in the desired direction.

These isolated and uncoordinated efforts are in any case unworthy of the great industry which tolerates them, and will be totally inadequate as a weapon wherewith to supplement a national technical and financial organisation for electrical supply such as was outlined by Mr. Williams in his address to the Institution of Electrical Engineers in April, 1916. Unless we can fittingly complement our enlarged views on electricity supply by an even more extended appreciation of "salesmanship" of electricity in its wider sense, we shall sacrifice no small amount of our possible progress during the next few years, and the first and most essential step to be taken must be to secure the goodwill and favourable opinion of the public generally; this is an imperative preliminary, both from the point of view of facilitating the subsequent efforts of those who, following the ordinary channels of salesmanship, endeavour to sell electric light, heat, power, &c., and the various apparatus associated therewith, and also with a view to interesting the investing public, and the capitalist, on whom every commercial venture is dependent.

One does not expect to raise much of a crop merely by flinging seed on to uncultivated land; yet the electrical supply industry of this country carries out its business in precisely this

way!—its real business organisation is a myth, and its "salesmanship" an anachronism.

To win the sympathetic support of the British public should be the first act of salesmanship, and this can only be achieved by the organised and systematic use of the daily Press throughout the country, not by way of advertisement as usually understood, but in an educational way, naturally, with an appeal to the self-interest of the reader. This, of course, implies an understanding between the electric supply industry and the Press generally, and a suitable organisation to deal with the matter, neither of which have any existence at the moment. We are not primarily concerned here with the ways and means of securing the desired end—unfortunately, there is no body representative of the commercial and business end of the *whole* of the supply interests in the country to whom we might appeal. Rather do we desire to emphasise the very real need for an industry, with something like £100,000,000 invested in the supply of electricity, and with immense prospects of development opening up before it, to take appropriate action with a view to influencing public opinion as a whole—in other words, preparing the ground for subsequent developments.

We are quite aware that in writing thus under the heading of "salesmanship," we have rather encroached on the sphere of publicity; to the hypercritical we would point out that the sole commercial end and aim in view is the sale, first of the "idea," then of the consuming apparatus, and finally of the electrical energy which it may utilise. To place the "idea" we must create a sympathetic attitude on the part of the general public; imbue it with the feeling that electricity is in some way part of its daily life, as it is, in fact, with a considerable number of more enlightened or more fortunately situated people.

It is quite true that this is a matter which should rightly devolve on a representative "development" committee, but unfortunately the nucleus development committee formed by the I.M.E.A. before the war is in a state of suspended animation, and, in any case, we cannot but feel that the outlook for electricity supply development in this country has undergone such a material transformation in the interval, that even this committee will require reconstituting on lines more in keeping with the national ideal which we now have in view.

It is possible that a reconstituted development committee, representative of the whole of the electric supply and allied interests of the country, and embodying in addition to, or conjointly with, its publicity sub-committee, a special "Press" sub-committee, for the purpose of facilitating friendly relations with the daily Press, so as to influence public opinion by its means, might meet the case. On the other hand, the matter is relatively of superlative importance and calls for some immediate steps, independently, at any rate in the first instance, if necessary, of any existing committee.

The Policy of Empire.

The past week has produced quite a crop of speeches from Ministers and other leaders respecting the coming problems of trade and industry. Mr. Long, the Secretary for the Colonies, as a guest of the British Empire Producers' Organisation at the Savoy Hotel, has referred to the vastness and the varied character of our Empire resources and the need for business men to play a greater part, and "politicians" a smaller part—but both working in co-operation—if those resources are to be developed and utilised in the common-sense interests of the people of the Empire. Mr. Robert Rodgers, the Canadian Minister of Public Works, has urged a policy of trade preparedness so that, on the signing of Peace, we shall not suffer from the lack of trade munitions as we had suffered at the beginning of the war from the want of war munitions. Sir Albert Stanley, as President of the Board of Trade, has reminded us, in a speech at the Aldwych Club, that if some of our past methods of doing business are not "scrapped," we shall fail to hold our place in the front rank of business countries. The enemy penetration policy—a serious fact that we had so long mistakenly tolerated—must not be allowed to continue, for this was a commercial era in which the efficient conduct of our great industries was vital to our welfare. Sir Albert, like the speakers already mentioned, dwelt upon Empire resources, and expressed the conviction that it was the duty of the Government to see that those resources were properly exploited. The workman must do his best in return for a day's wage, but the employer also must do likewise. We must profit, too, by the experience of other countries, and if it was found that small undertakings could not exist in competition with the great foreign combinations, we must adapt our methods to meet that form of competition. Our industries must be carried on as efficiently as those of our foreign competitors, and we must be able to produce manufactured products at a price that would compare with theirs; if not, how could we hope to stand up against them? Lord Northcliffe followed with the advice, which is so familiar to the electrical industry, that concentration or combination in place of small and scattered businesses has been proved by the war to be one of the essential things for the coming days. Mr. H. Samuel, M.P., has been speaking on the reorganisation of the Empire, and showing the need that exists for an Imperial Executive which should initiate policy for the Empire as a whole. Lord Rothschild followed Mr. Samuel with a reference to the parts of the population that are not now represented in Parliament, and to the wisdom of having their views somehow represented. All of the foregoing matters will be recognised as being very closely related to engineering and industrial affairs. They unitedly serve to emphasise the truth of what has now been said so many times, and in so many ways, namely, that our real interests as a people, whether as capitalists or workers, will be best served by a far-seeing Imperial development policy, by the use of modernised industrial and commercial methods, and by a more adequate representation of industrial affairs in the Councils of the Empire. How strikingly similar to the policy which Mr. Hughes, the Prime Minister of Australia, energetically and forcefully elaborated before so many audiences here on the occasion of his memorable visit! The present War Cabinet has unanimously pledged itself to an Imperial preferential trade policy which shall show regard for our Allies, and shall not increase the cost of food, after the war. Mr. Lloyd George and Mr. Bonar Law have cleared the air by their definite statements on this subject during the past week. Surely our leaders are progressing in the direction of a concrete policy of great promise!

Employers and Employed.

The excellent address of Mr. Michael Longridge to the Institution of Mechanical Engineers, which we abstract elsewhere in this issue, deserves special mention in connection with the speeches to which we have referred above, for it not only anticipated them in many respects, but also was characterised by candour and courage which compel our admiration. The President fearlessly pointed out the faults of both masters and men, and also put forward views upon the necessity of reform in education and in organisation, which we commend to the attention of our readers, regretting only that we have not space to reproduce the address in full.

THE BRITISH WESTINGHOUSE CO.'S WORKS, MANCHESTER.

Visit of Colonial Representatives.

On the 21st and 23rd ult. the representatives from the Oversea Dominions (including the Right Hon. Sir Robert Borden, the Right Hon. William F. Massey, and the Right Hon. Sir Edward P. Morris) and the Empire of India (including the Maharajah of Bikaner, Sir James S. Meston, Sir Satyindra Prassana Sinha, and Sir James R. Dunlop Smith) paid a visit to the British Westinghouse Co.'s Works at Manchester.

Fig. 1.—Group of Ceiling Fan Motors.

The works occupy 160 acres in Trafford Park, of which approximately 40 acres are roofed in. Building operations were commenced in the year 1901, the manufacture of goods commenced early in 1902, and since then the volume of business done by the company has steadily and progressively increased. Extensions of buildings were made from time to time, and further extensions are now in progress.

The whole of the works are now engaged at the highest pressure, the number of employés being over 10,000. Included in this aggregate are a large number of women workers, and it is interesting to note that these total approximately 2,500 more than in pre-war times. The women wear neat khaki overalls, and are engaged in nearly all departments of the works. A number of special canteens have been provided for their use, and their general welfare is specially cared for by a "Lady Superintendent of Women Workers."

Over 2,600 men have left the company's employ since the outbreak of war to join the Colours, and of these about 200 have given their lives for their country.

The diversified character of the manufactures of the company was well illustrated by the exhibits displayed. Apart from special orders, on which a large amount of work is being done, the company's products at the present time include steam turbines, turbo-blowers and compressors, condensers, pumps, vertical and horizontal gas engines, Diesel engines, and electrical machinery of all kinds, including traction equipment for railways and tramways, electric locomotives, transformers, switchgear, control gear, meters and instruments for all purposes, motor-car magnetos, and accessories for lighting, heating, cooking, and general power purposes.

The range of sizes manufactured was amply illustrated in turbines for turbo-generators, ranging from 15,000-kw. capacity for electricity supply undertakings down to 100-kw. sets for ship lighting. In another department, motor armatures of 7,500 h.p. to 15,000 h.p. were placed next to a motor armature having a capacity of $\frac{1}{32}$ h.p. Similarly, a shaft belonging to a fan motor, weighing less than 4 oz., was placed alongside of a shaft of approximately 20 tons weight, belonging to a 15,000-h.p. rolling-mill motor, which we illustrate herewith.

The company have a school in the works for the instruction of apprentices. Two grades of apprentices are accepted—one consisting of graduates in engineering, and other technically-trained men, who are allowed to take a two or three years' course of a varied character in the shops, testing departments, and offices; while the other consists of boys who enter the works between the ages of 14 and 16 years, and remain until they are 21. During this time, the boys are given experience in various departments of the shops, and also provided with instruction in the Works Trade School. The whole of the lecturing work is undertaken by members of the company's staff, the lecturers numbering about 40 in all.

An interesting development due to existing conditions has been the attempt suitably to train educated women to enable them to fill posts of intermediate responsibility in the company's office staff.

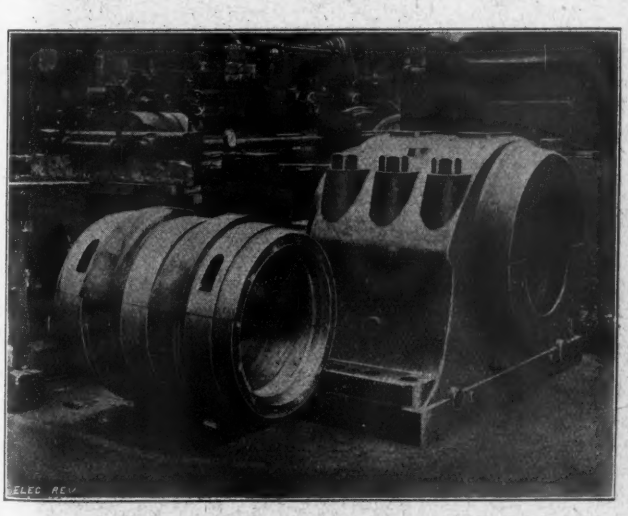


Fig. 2.—Bearing and Bearing Housing of 15,000-h.p. Rolling-Mill Motor.

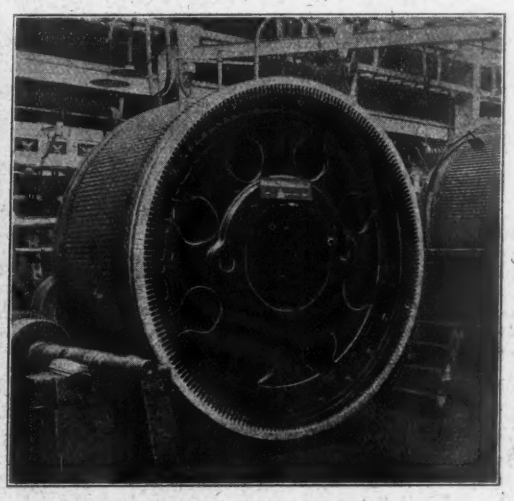


Fig. 3.—Armature of 15,000-h.p. Motor.

The Westinghouse Co. has now direct representatives all over the world, and under normal conditions does an enormous volume of export business, in addition to that for home trade. We reproduce a number of photographs of some of the interesting exhibits that were shown to the visitors.

Fig. 1 represents a group of motors for ceiling fans, part of orders for 2,000 of these machines for use in British military hospitals in Mesopotamia.

Fig. 2 shows the bearing and bearing housing for the

shaft of a rolling-mill motor of 15,000 H.P., fig. 4 the shaft, and fig. 3 one of the two D.C. armatures that will be mounted on the shaft of this motor.

Fig. 5 shows two of three ship-lighting sets just completed for Messrs. Harland & Wolff, Ltd. These sets consist of impulse-type back-pressure steam turbines, driving the generators at a speed of 3,000 R.P.M. at a continuous output of 125 KW., 400/450 volts, when supplied with steam at 150 lb. gauge and exhausting into 5 lb. gauge back-pressure. The generators are compound wound, and are supplied with static balancers to be suitable for supplying energy to a three-wire circuit. The machines are fitted with the Westinghouse patent radial type of commutator, which ensures good contact between brushes and commutator, independently of cross-axial vibration, and with small pressure between the contact surfaces, thereby reducing the wear of both brushes and commutator to a negligible amount.

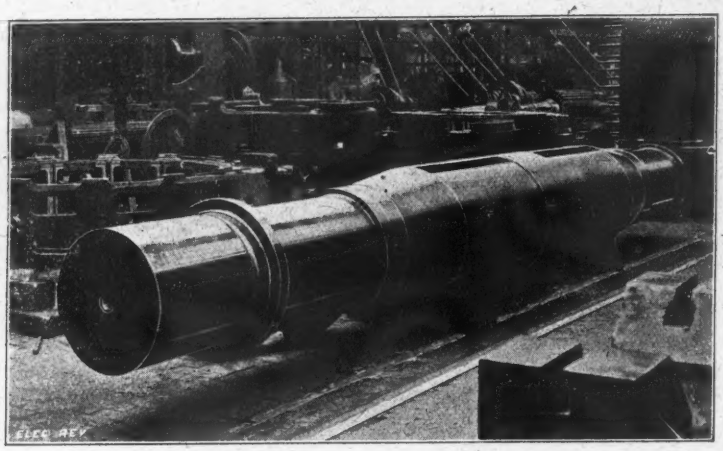


FIG. 4.—SHAFT FOR ROLLING-MILL MOTOR.

WAYLEAVES.

MR. C. VERNIER'S paper on "Wayleaves" was read and discussed at a meeting of the YORKSHIRE LOCAL SECTION OF THE INSTITUTION OF ELECTRICAL ENGINEERS at Leeds on April 25th.

Mr. W. B. WOODHOUSE said he was rather restricted in discussing the question, because he was serving on committees which were dealing with this matter. One of these bodies had already given evidence before a Board of Trade Committee as to the necessity for compulsory powers for wayleaves, and no doubt would give evidence before the new committee. He thought that the feeling was that the question of wayleaves should be referred to a tribunal set up to deal with all matters of electricity supply. If they were to get compulsory powers it was most essential that they should make the public appreciate the fact that they were only asking for what was reasonable. His own experience of obtaining local authority consents and wayleaves had been very much like that of the author. A case in which compulsory powers were necessary for underground mains was that of streets dedicated to the public, but not taken over by the local authority. In recent years a large number of Gas Acts had contained a provision that, in such cases, the undertakers might lay gas pipes to supply the houses in such streets. It was a very valuable power, and just as necessary in relation to electricity as to gas.

Mr. T. B. JOHNSON said there was one strong ground of claim for better powers which was not mentioned in the paper, and that was the enormous improvement which there would be in the atmosphere when they got a large extension of electrical power. No one who compared the conditions and the atmosphere in Newcastle 20 years ago with that of to-day could fail to realise the difference owing to the number of electric power companies at work. It was high time that the public should recognise that electric power had become a prime necessity, and that, therefore, the rights of individuals or of private property could no longer be allowed to stand in the way of its distribution. The getting of the approval of the Board of Trade would be valuable, because the fact that they had to go to the Board would in itself prevent supply companies from making unreasonable demands, and would meet the objection of the public to facilities being granted to private companies which were making dividends. It was rather hard to expect replies within a month in the cases of small public bodies, the members of which lived in scattered localities, and did not often meet. He thought also that colliery companies could not expect to be able to run their machinery to the very last gasp and then to find an electrical authority 20 miles away able to link them up within a month. He was glad to see that the author proposed a tribunal on which there should be no lawyers. Time and cost would be saved to a very considerable extent thereby. The mere knowledge that compulsory powers existed would have the effect of making the application of such powers unnecessary except in special cases. The Post Office had not yet had occasion to go to the Courts, but they had unquestionably had cases where unreasonable demands had been disposed of without trouble because the other side hesitated to make public the terms which they had required for facilities which, though they would be valuable in the public interest, it would have cost them nothing to concede, and the knowledge that they would have to go and justify such terms had certainly resulted in their withdrawal. He had no doubt that the electrical companies would have a similar experience if they had the help of such powers.

Mr. W. H. BROWN said that, from conversations which he had had with factory owners and others, he found that there was a disposition to object to let overhead wires run over their property on the ground that it might benefit their neighbours who might, perhaps, be in competition with them in business. Good might be done through such assemblies as the chambers of commerce inducing people to see the national bearing of the matter of wayleaves.

Mr. W. LANG said that there would always be trouble in approaching people unless they remembered the point of view of the owner also. There was need to educate their wayleaves men how to go about the matter; those would be most successful who had the keenest appreciation of the human element. The question of compulsory powers for wayleaves had been forced upon the industry, and Mr. Vernier's recommendations were very fair to all parties.

Mr. E. C. WALLIS said it was high time that the rights of the private owner were limited. There was no country on earth where the rights of the private owner were more considered than they were in the United Kingdom; but it must be declared that the rights of civilisation were higher. They did not want this country spoiled as some parts of Canada were, but compulsory powers, under proper restrictions, were a vital necessity.

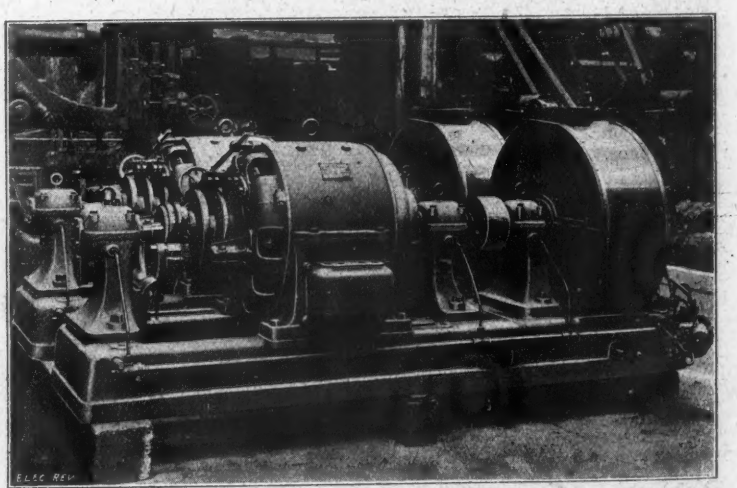


FIG. 5.—WESTINGHOUSE SHIP-LIGHTING SETS.

Mr. VERNIER said it was generally agreed that compulsory powers were essential, and the discussion seemed to turn

more particularly on the need of educating the public. With regard to the powers of gas companies in new streets, Newcastle had those powers. He had been very glad to hear from Mr. Johnson that so far the powers acquired by the Post Office last year had had a satisfactory result, and that people would not come into court and state their terms. He was quite convinced that if people had to stand in broad daylight and make a statement of what they considered to be a reasonable rent they never would dare to do it in many cases. He did not think it was possible at all to contemplate any electricity supply undertaker having the right which the Post Office had. The Postmaster-General, of course, had executive power, but the supply undertaker had not, though the President of the Board of Trade could act for him, and it would be hopeless for them to try to get past the Board of Trade, for Parliament would never entertain the idea. With regard to the suggestion that the period of a month was a short time for the reply from the private landowner, in the case of powers for breaking up streets scheduled in a provisional order under the Electric Lighting Acts the landowner was expected to give an answer within three weeks if he wished to go to arbitration. The non-statutory undertaker was not subject to any Board of Trade regulation at all until the Board of Trade served him with a notice, and, as a rule, they did not do that until some accident happened, or the Postmaster-General wanted something done which he could not get done; so that many of these lines did not comply with Board of Trade regulations, and that was very unfair to statutory undertakers, because the workmanship was often indifferent, and the position was that, after an accident happened, the Board of Trade had to make a regulation to prevent a similar accident, and then the statutory undertaker got it; so that the position was not at all satisfactory. The people who needed educating were the landowners, who were, perhaps, not largely on the chambers of commerce; still, perhaps something might be done through those chambers from the publicity point of view. There was a great lack of information amongst the public about the regulation of public undertakings. Such undertakings were regulated by the State, and could not make unlimited profits. They were given a reasonable return on their capital. Take a company working under a provisional order. Maximum prices were scheduled, and the Board of Trade could revise these periodically. If the undertaking proved to be a gold mine, the local authority could purchase it. The Board of Trade, the public, and the consumer alike had a fair hold on the undertaking. In the case of power companies, the dividends were restricted to 8 per cent. If the price charged fell below the rate scheduled in the Order by 1¼ per cent. the dividend could be increased by a quarter of 1 per cent. These scheduled prices were subject to alteration under certain conditions. The only difference was that power company undertakings could not be purchased by local authorities. Any earnings which might be more than 8 per cent. had to be divided between the consumers and the shareholders. When there were companies of that sort under State control they should have all the privileges of the State undertaking, whether they were owned by the State or put into the hands of a company with suitable regulation. In either case the public interests demanded that the service should be given. If the public interest suffered because the company was looked upon as making a profit, it was fundamentally wrong to give these powers to the company. If the Post Office could get compulsory powers there was no reason why the company should not also get compulsory powers, because it should rank exactly on the same footing as a State undertaking. Overhead lines should be reserved for the most important transmission or trunk mains. The little overhead lines for distributing purposes were not worth putting up, when they considered the maintenance and repairs. Though they might save something in the early development of a district by putting up overhead wires for low-pressure distribution, the day was bound to come when the district had grown so much that the overhead lines would have to be taken down and put underground. Trunk mains were not so numerous, and they had to be run well away from towns and villages for reasons of safety, and he thought that powers for them should have the first claim, at any rate. He attached considerable importance to being able to run underground mains across country. He had done this in cases in which it had saved a good deal.

Council of American Engineering Societies.—At the annual convention of the American Institute of Electrical Engineers in 1913, Dr. W. McClellan presented a suggestion for the engineering profession to form a national body representative in its membership of all national engineering societies.

An organisation such as was then outlined is now in process of formation, and was referred to by President Buck, of the American Institute of Electrical Engineers, at a recent convention of that body. The functions of this Engineering Council are to provide for convenient co-operation between engineering societies for the proper consideration of questions of general interest to engineers and to the public, and to provide the means for united action on questions of common concern to engineers. Preliminary meetings have already been held, and a tentative set of by-laws drawn up.—*Electrical World.*

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Electric Vehicles.

At the risk of repeating oft expressed views, may I be allowed to point out what I think are the chief obstacles to the speedy evolution of the electric vehicle? They are:—

1. Want in standardisation of battery, both in size, means of connecting, capacity, and voltage.

2. A national company to own all batteries and charge them.

Imagine the above to have been realised. Well, mine is a big car; I take on three standard batteries at Avonmouth which are connected in parallel by being merely placed in position (the petrol can); I change them at Birmingham, again at Huddersfield, and finally reach Newcastle. Now as part of the equipment of my car, but belonging to, or approved by, the supply company, I have a meter which was read at Birmingham and Huddersfield, and the readings sent to the central office, from which I eventually receive my weekly or monthly account, according to my standing with regard to credit.

Also as part of the equipment, there should be a loose-handle sealed circuit-breaker for the protection of the battery. This should be supplied by the company, a small rental being charged. Under the present system, or want of system, imagine the difficulty of charging at a reasonably low rate seven or eight batteries of different voltages and charging rates at the same time, whilst the cars are waiting.

Finally, I ask what would be the position of the petrol car to-day if there were seven or eight widely different kinds of petrol, and as many sizes of cans to carry it in?

E. F. Rowley.

Avonmouth, *April* 27th, 1917.

Central Station Employés.

[We were recently asked by a correspondent whether all central-station and sub-station workers are entitled to the 5s. increase granted by the Ministry of Munitions. If so, whether it was compulsory that it should be paid. Further, whether they are entitled to the 3s. granted to engineering workers last October. We have received the following communication on the matter from Mr. W. J. Ebben, the hon. general secretary of the Association of Electrical Station Engineers:—]

The 5s. increase referred to was not granted by the Ministry of Munitions, but is the result of a decision of the Committee on Production given in settlement of a demand by the Federation of Engineering and Shipbuilding Trades made to the Engineering Employers' Federation for increased wages. The electricity supply authorities are not represented in the Engineering Employers' Federation. The decision applies to the members of the various trade unions affiliated to the Federation of Engineering and Shipbuilding Trades, and a number of electrical station employés of various grades are members of the Electrical Trades' Union, the Amalgamated Society of Engineers, and one or two other unions who are members of the Federation.

I believe there is a clause in the decision which deals with men employed outside the generally recognised engineering trades, and the question whether in these cases the 5s. increase should be paid will be settled by the Committee on Production.

It cannot be said that it is compulsory that the 5s. or the 3s. be paid to sub-station and central-station workers, but they are quite at liberty to apply to their employers for it, and, failing a satisfactory result, they can appeal through their organisations to the Committee on Production, if they are members of an organisation; if not ——? A total of 12s. has been obtained by the Federation.

A few lines on the present position of the Association of Electrical Station Engineers with regard to the various increases in wages that have taken place in the engineering industry may be of interest. The A.E.S.E. for the last year has been inactive, perhaps owing to the inactivity of the members, and, again, owing to the various officials being more occupied with their businesses than with the A.E.S.E. The official A.E.S.E. work has to be done in spare time, and there is very little spare time nowadays. The present inactive position of the A.E.S.E. is the result of the apathy of station engineers as a class; they wanted an organisation, and the members generally tied the hands of their own committees at the beginning. The members of the Association were dead against trade unionism or any affiliation to any federations, and now they want a 5s. rise.

The writer still vividly remembers the horror and the indignation when he seconded an amendment which was proposed by a member of the Electrical Trades' Union at a meeting of electrical employers and employés in London some years ago. This was the only time the London chief electrical engineers really took the A.E.S.E. seriously. As soon

as the general committee and members severed all connection and correspondence with the E.T.U., the London chief station engineers, being clever and far-seeing men, ignored the A.E.S.E. members, and have done so ever since, because they knew they had nothing to fear. A new era is fast approaching when every man outside an organisation will have to review his position; employers are fast seeing that it is better to deal with an organisation of employés than with individuals.

Conditions in the engineering industry are rapidly changing, and the organisations want all the men of high intelligence and good education, some of the men who have been standing aloof. There is the nucleus of an organisation in existence to amalgamate the metal and engineering trades with the ultimate idea of the workers taking part control of the industry. It is an idea that will grow.

Electrical engineers must take an interest in the general condition of the electrical industry at all times, and not at the moment when somebody else gets a 5s. rise. They must read; they must work; and they must organise. Trade Unionism to-day means something different to what it did two years ago. The lawyers, the doctors, and the electrical station managers, are highly organised, and employers expect their employés to organise; it tends to peace and better conditions. Electrical engineers are being roused by other trades going ahead of them. Station engineers are thinking, and when they think the future looks to me much brighter.

Organise and improve the electrical industry, and the electrical industry will improve you!

W. J. Ebben.
Hon. Secretary, A.E.S.E.

26, Little Park Gardens, Enfield.

Electrically-Operated Valves for Internal-Combustion Engines.

I have read the interesting description of the valve arrangement of Mr. Jos. C. Youngblood, of Atwood, U.S.A., and beg respectfully to point out that this method of operating the large valves of high-powered marine, locomotive, and industrial internal-combustion engines was embodied in my designs of "Paragon" cycle engines in connection with my electrical ship propulsion system, and my locomotives, and also that this type of efficient valve operation and control was embodied in the designs of the 4,000-H.P. units which I proposed in my large "County of London gas-generated electrical power supply scheme" in 1914.

The first mention of the merits of this method of timing and control was in connection with my paper on "Internal-combustion Engines," read before the Institute of Marine Engineers, at the Engineering Exhibition, on Saturday, September 17th, 1910.

There is no question as to the economies that can be effected, and in my opinion it is essential in the coming large-powered internal-combustion motors that "electrically-operated" valves, &c., be employed, for dozens of good commercial reasons.

William P. Durtnall,
M.I.Mar.E., M.I.Loco.E.

London, N., *April 30th*, 1917.

P.S.—The valves were to be pulled off their seats with highly efficient variable control, got by no other method so effectively as by "electromagnetic power."—W.P.D.

The I.E.E. Nominations.

A very strong effort is being made to further the claims of Mr. G. W. Partridge as one of the Vice-Presidents in the forthcoming election of the Institution of Electrical Engineers.

Many of us who have been associated with electrical engineering for the last quarter of a century have very clearly appreciated Mr. Partridge's services. His electrical attainments are well known. He has been associated for years with one of the pioneer high-tension systems, and obviously possesses unusual knowledge of the public service of electric supply.

As chief engineer of the London Electric Supply Corporation he has been deeply concerned in the latest developments of electrical machinery, and as his company supplies electrical energy for the London, Brighton & South Coast electrified line, which is one of the few lines in Europe operated on a single-phase system, it is clear that he is in closest touch with the modern developments of electric traction.

As far as the Institution is concerned, Mr. Partridge has the advantage of having been twice on the Council, and in consequence is in touch with the questions affecting the industry that are likely to come before the Council during the two or three critical years that are approaching.

Member.

THE ENGINEERING INDUSTRY.

IN his presidential address to the INSTITUTION OF MECHANICAL ENGINEERS on April 20th, Mr. MICHAEL LONGRIDGE said that the war had taught us many things, but none more clearly than the importance of our engineering industry, upon which we depended for victory to-day, and for security and prosperity to-morrow. Action was urgently necessary to avert its loss after the war, and to regain the pre-eminence which British manufacturers had lost. Reviewing the advantageous conditions under which mechanical engineering had developed in this country in the past, he pointed out that the mechanical engineer, though a trustee for the Empire, and responsible for the transformation of the nation from an agricultural and practically self-supporting nation into a manufacturing community dependent for its existence upon imported food, had not invoked the aid of science or cared for the welfare of the thousands of employés, nor had he given the latter a fair share of the profits of his business. There was a time when Lancashire was supreme beyond dispute in the engine-building trade, but at the Paris Exhibition in 1900 Mr. Longridge discovered that the Continental engines excelled in appearance and detail any he had ever seen, and presented a startling contrast with the inferior exhibits of British manufacturers. Nevertheless, the Exhibition failed to produce any important changes in the practice of British engine-building firms, for the men in authority were trained exclusively in the shops, and men provided with technical training had not yet acquired any effective influence on current engineering practice. Consequently, when repeated loss of orders forced British engineers to recognise the estimation in which Continental work was held by customers, foreign draughtsmen were employed and foreign designs adopted, while foreign-built engines were purchased and erected even in Lancashire itself. In the meantime, famous British engineering firms were being wound up. In some cases the inducement to buy abroad was lower price, or earlier delivery, but in most it was a guaranteed rate of steam consumption which could not be obtained at home, though it should have been. Most other branches of mechanical engineering had suffered more or less from foreign competition, due partly to inefficient technical education, lack of trade organisation, and the policy of the trade unions.

In the early days of the Institution most engineers were trained entirely in the shops. Theoretical knowledge was uncalled for, and even held to be antagonistic to practical success. There was no supply of scientific engineers, partly because there was no demand, and partly because the places where a man could study the theoretical side of his profession were few and far between.

The foundation of the City and Guilds Central College in 1880 marked the first public recognition of the need of something more than office or workshop training for the engineer. In 1890 the transfer of the control of technical education from the school boards to the local authorities initiated a vast expenditure on technical schools of all ranks, and was followed by the provision of engineering courses in most of the older, as well as the new, universities; but the problem had not been solved. The functions of the engineer and the craftsman were entirely different, and their training must be different also; moreover, differentiation was needed in the training of the various classes of engineers and workmen, and the lack of differentiation seemed to be one cause of the inefficiency of our technical education relatively to its cost; another was the insufficient preparation of those entering the technical schools. The education available for the higher ranks seemed fairly satisfactory, but many men of high mental qualities were unable to assimilate much book learning, and it was a mistake to force them through the same collegiate course as men of different mentality. Further, the obstinacy of Oxford and Cambridge Universities in retaining Greek as a compulsory subject in their examinations reacted upon the public schools, and was a serious handicap on those who, intending to deal with the concrete rather than the abstract in their future lives, yet wished to find their level in the social life and moral discipline of these two universities.

The education provided for the workmen, on the other hand, both general and technical, was most unsatisfactory. Trade apprentices seldom had opportunities for learning other than at evening classes. In parts of Scotland parents and employers were compelled to send young people to continuation schools during working hours, between the ages of 14 and 17 years; in some large works in England promising boys were allowed to spend some of their working hours at technical schools without loss of time or pay, and in others technical instruction was given in the works, but lack of co-operation prevented such arrangements from becoming general. Yet the workman must have better education, and either the age for leaving school must be raised or some scheme devised for combining technical instruction in the works with general instruction in the schools in working hours. Technical colleges of University rank should provide courses for designers and managers, admitting only those capable of profiting by the teaching. The idea of "free university education for the million" was "most pernicious nonsense." Senior and junior technical schools should simi-

larly have separate courses for foremen and for those likely to remain manual workers. The work should be coordinated between the secondary schools and technical schools or colleges, and a uniform system of adequate scholarships should be established.

Passing on to the subject of organisation, or the lack of it, Mr. Longridge said that the work of the consulting engineer was decreasing in importance, and he would become rather an inspector than a designer as men of science and high technical ability assumed their proper places in works. Manufacturers, however, should give their customers more precise and detailed information about their products. They would benefit by the interchange of ideas, secrecy being folly—the secret of success in mechanical engineering nowadays lay in quality and workmanship, not in drawings.

Workshop organisation had not received sufficient attention here; unorganised shops would be driven out by those in which scientific management prevailed, and the endeavour was made to get the workman to regard his work more as a problem to be solved than as a task to be got through. Not only on the manufacturing side, but also in the commercial department organisation was inadequate; each firm had its own agents, many of them without engineering knowledge, instead of central selling agencies, and the position of a commercial representative was too uncomfortable to attract the right class of men. For foreign representatives, cultivated men with expert knowledge, the social equals or superiors of those with whom they dealt, were necessary; small firms could not afford to employ such men, or to keep their machinery up to date, or to obtain scientific assistance, and some kind of combination or co-operation seemed very desirable, as had occurred in other trades and in other countries. Mechanical engineering should be represented by a powerful body, such as the British Engineering Association and the B.E.A.M.A.; in these associations might be found the components of a practical and effective scheme for the organisation of the British engineering industry, and Mr. Longridge sketched the outlines of such an organisation, together with a similar scheme for the men, the two following parallel lines from the manufacturers and the shop stewards respectively up to the Minister of Industry and Commerce, who did not as yet exist, but might be developed from the Minister of Labour.

Turning to the relations between employers and employed, and the negotiation of a treaty to secure a lasting peace between them, upon which the future of the British Empire depended, Mr. Longridge referred to the Government pledge to restore all the Trade Union rules and customs which had been abrogated for the duration of the war, and said he hoped the Trade Unions would have learnt, before the war ended, that a policy of limitation of output and earnings was as injurious to the workman as to his country, and would ultimately ruin both. Competition with other nations was impossible under such conditions. But if the unions voluntarily gave up their restrictive system we were bound to give them some acceptable equivalent, and he welcomed the report that conferences were being held between representatives of both parties with a view to the negotiation of a treaty of industrial peace. He advocated a spirit of sympathy and great forbearance; if the policy of the men had aroused indignation, the employers themselves were not free from blame. Reviewing the history of a hundred years' warfare between employers and employed, he pointed out the hard conditions which oppressed the workman in 1817, and the injustice meted out to him by Acts of Parliament, whence arose the intolerance and selfish economic policy of the Unions.

Limitation of output and objections to piece-work were partly due to the short-sighted policy of the employers in cutting piece-work rates, so that a workman's earnings were limited by precedent; the fear of unemployment also prompted the workman to limit output, lest the market should be glutted, a delusion which could only be removed by education. It was necessary to convince the workers by experience that piece-work, co-partnery, and large output were to their advantage, and that only by putting the best machinery to the best use could high wages, relatively to the cost of living, be maintained. As the Prime Minister recently pointed out, in connection with shipbuilding, wherever payment by results had been adopted there had been an increase in the output of 20 to 40 per cent.: it involved an undertaking on the part of the employer that if large wages were made by men as a result of special effort, no advantage must be taken of that to reduce the rates—that had been the great folly of the past.

Another question that would have to be considered was the length of the working day; it might be possible, if the unions allowed the men to do their best, to adopt an eight-hour day, but in the engineering trade standing charges and interest on cost of machinery amounted to several times the wages bill, and ran on while works were standing idle. Would it be possible to introduce a two-shift day, changing over once a fortnight?

The three great disputes in the engineering trades arose out of the qualification of men to work machines, hours of work, and limitation of output; in the first and last public sentiment and right were with the masters, who won, in the second with the men, who won. He believed there was a power that worked unceasingly through right and wrong to weave the tangled web of anarchy into the pattern of an ordered life, and that these ephemeral troubles were but means that it employed to lead both sides to a right conception of their duties to each other. That this enlightenment would come was sure; the ignorance of men, their prejudices and their greed, alone postponed its advent. If they could bury strife, suspicion, and ill-will, the ideal of industrial life would be in sight.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

A Large Spinning.

The accompanying illustration shows a special spinning in course of production, one of a large quantity which have recently been supplied to an important Government contract by the Benjamin Electric, Ltd., of 1A, Rosebery Avenue, E.C. Finished spinnings will be noticed in the foreground and middle of the picture. These were spun in aluminium from blanks 42 in. in diameter, of 18 gauge metal, the finished spinning measuring 31 in. in diameter and 16½ in. in depth.

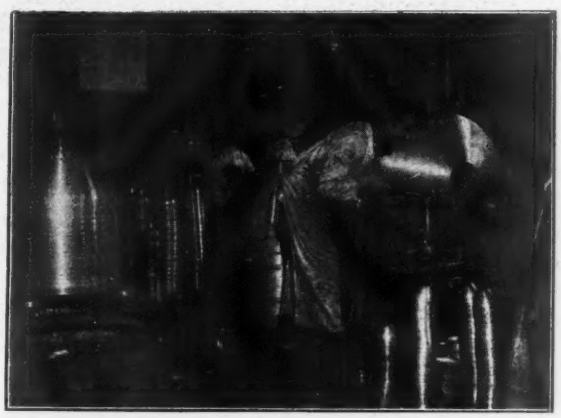


Fig. 1.—A Large Spinning.

This is only one example of the widely varied types of spinning produced at the Rosebery Avenue Works, where a complete metal-spinning plant is installed capable of turning out all classes of spinning work, especially that of an unusual or novel character. In this category the company's past achievements guarantee their ability to produce successful results.

Siluminite: a New Insulator.

The essential qualities of a perfect insulating material are high electrical resistance, high dielectric strength, high tensile and compression strength, immunity from attack by acids, alkalis, and oils, that it shall be easy to mould and to machine, and able to withstand exposure to high and low temperatures, that it shall be non-hygroscopic and waterproof, and that it shall be cheap. There are numerous varieties of insulators which possess some or other of these qualities, but none which answer to them all. Perhaps it would be too much to expect that perfection should be attained in this world, but it is right to aim at the ideal and to strive to attain it. We therefore accord a hearty welcome to a new insulating material introduced by the Siluminite Insulator Co., Ltd., of The Green, Southall, which possesses a remarkably large proportion of the qualities above scheduled.

We have been favoured with some samples of Siluminite in the forms of rod, sheet, tube, and moulded insulators, and have submitted them to such mechanical tests as are at our disposal. The material is a hard black substance, ringing like slate, but of far greater strength; it can be sawn, filed, drilled, tapped, turned, and polished with ease, and can be moulded to any shape in the course of manufacture, but not afterwards. It is not softened by heat (it is subjected to a temperature of more than 600° F. at the makers' works) and is not brittle. Immersion in oil or caustic alkali, or boiling water, leaves it unchanged, and it is non-hygroscopic. It possesses high dielectric strength, this being between 10,000 and 13,000 volts per mm. as tested by the National Physical Laboratory. Its structure is homogeneous and dense, the weight of a square foot ¼ in. thick being 2·4 lb. The substances with which it will most directly compete are porcelain, glass, mica, fibre, ebonite, wood, slate, marble, and moulded compounds. While Siluminite possesses most of the qualities of these materials, it excels in respect of its mechanical strength; this fact is illustrated by the following statement of tests made by Mr. E. T. Brook, of the Metropolitan District Railway, on tramway and railway insulators:—

"No. 1. *Siluminite L.C.C.-pattern Insulator.*—This insulator was fixed in a frame, and, by means of a hydraulic ram, the pin

was drawn. With a pressure of 36 tons, the Siluminite broke away inside the outer casing and the pin commenced to draw.

"No. 2. *Porcelain L.C.C.-pattern Insulator.*—This insulator was subjected to a similar test as No. 1, and at a pressure of 6·7 tons, the porcelain broke away, and the pin pulled out.

"No. 3. *Siluminite Negative Rail Insulator.*—A crushing-strain test was made on a third rail insulator 3¼ in. high, 4⅛ in. diameter inside the petticoat, and at 50 tons pressure the outer parts of the base broke away from the centre, but the centre remained solid.

"No. 4. *Porcelain Negative Conductor Rail Insulator.*—This was tested in a similar manner to No. 3 on the Siluminite insulator of the same pattern, with the following results:—At 8·9 tons pressure, the insulator cracked in two places about half-way through. At 18 tons pressure, the insulator split into a number of pieces.

As regards the electrical properties of the material, the following tests were also made by Mr. Brook:—

"No. 1. *Siluminite Negative Rail Insulator.*—At a pressure of 28,900 volts this insulator flashed across from the cast-iron cap to the top of the base clip.

"No. 2. *Porcelain Negative Rail Insulator.*—At a pressure of 28,100 volts this insulator flashed across at the same point as No. 1.

"These tests show that the flashing was due to surface leakage, and the fact that the base clip is pointed at the top."

The material was submitted for test to the National Physical Laboratory with satisfactory results, which we hope to publish shortly.

Perhaps, however, the most convincing demonstration of the strength of Siluminite is its use for rail insulators *witkout the aid of the usual iron cap.* We illustrate herewith examples of their application on the Metropolitan District Railway, where they have been subjected to severe practical tests, and have been on the track since June of last year. The larger insulator weighs 8 lb., and is designed for use without the usual malleable cast-iron clip to hold the positive conductor rail; the smaller insulator is also designed to dispense entirely with the metal clip, and the negative conductor rail is simply laid in the seating on the top of the insulator. Figs. 2 and 3 show the top and base of the former, and fig. 4 the latter type of insulator. An anchor insulator is also made for railway work.

Passing to the other extreme, we understand that ignition plugs for motor-car engines, made of Siluminite, have successfully withstood the high temperature of explosion for long periods without deterioration in any respect.

In addition to the properties before mentioned, Siluminite is found to withstand the effects of lengthened exposure to an atmosphere highly charged with ozone, and orders are in hand for sheets of dielectric for the ozonisers of an underground electric railway ventilating system.

Metal parts can be insulated by compressing Siluminite on to them in any desired shape or form, thus avoiding the cementing or screwing process now necessary in most cases. The most notable instances are those of insulated bolts for transformers, and conduit, track, and overhead insulators for electric railways and tramways.

The Siluminite Insulator Co. are in the quoting list of the Ministry of Munitions and the Royal Dockyard, Woolwich, and their material is in use in many munition factories, including the Royal Air-Craft Factory, Farnborough; they are supplying, amongst other firms, the Igranic Electric Co., Ltd., the Solenoid Regulator Co., and the Midland Electric Manufacturing Co., Ltd.

As regards the limitations of the material, it is not at present made in sheets thinner than ⅛ in., and it is not claimed that it is acid-proof. The numerous applications to which it can be put, in view of the foregoing description, need not be detailed to electrical readers, who will readily see that it offers a wide range of possibilities. And it is remarkably cheap.

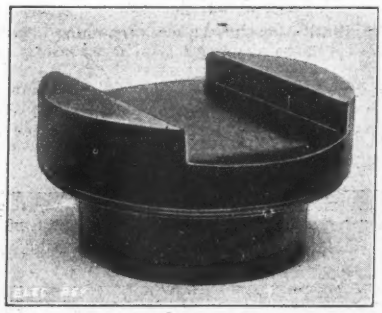


Fig. 2.

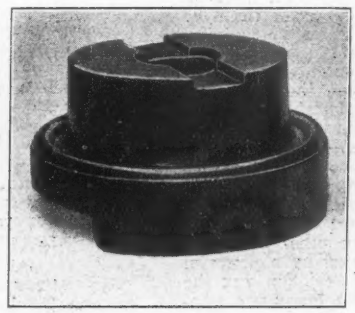


Fig. 3.

Fig. 4.

Siluminite Rail Insulators.

Combined Switch and Plug.

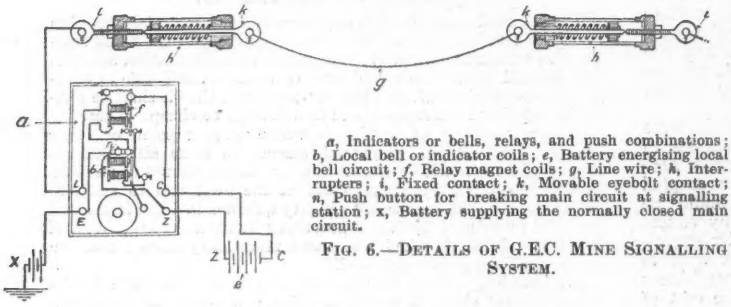
Messrs. Ward & Goldstone, of Sampson Works (Salford), Manchester, in connection with their recently issued list No. 103, describe the "Banquo" interlocked plug and switch (fig. 7), which we gather has been extensively adopted by the trade. It is substantial in design and of waterproof construction, consisting of an iron base, screwed for ¾-in. conduit, and fitted with a three-pin plug (one pin being for earthing). It has a carrying capacity of 5 amperes; the plug top piece is made of gun metal, and has a cord grip arranged to take cab-tire cable or the firm's standard tough rubber flexible cable. The arrangement can be supplied with a double-pole switch if desired.

We may add that Messrs. Ward & Goldstone list a number of patterns of plugs and switch-plugs adapted for domestic or factory use.

Signalling in Collieries.

A novel and interesting system of signalling on haulage roads in coal mines has been developed by the General Electric Co., Ltd., London, representing a distinct departure from current practice. The essential principle is the use of a circuit normally closed, the interruption of which causes the bell to ring—an idea incorporated in some burglar alarms, &c., but entirely novel, we believe, in the present connection. A single insulated line wire is used, which serves the purpose of a pull wire, and carries the operating current, which has a maximum value of 0·02 ampere at 6 volts, and is therefore free from any possibility of causing ignition of explosive gases. The return is by earth; but if an efficient earth cannot be obtained, a bare wire is run along the road for the return. The apparatus consists, in addition to the line and a battery of four Leclanché cells, of specially-designed mining-type bells and relays, and patent interrupters, which are fixed at intervals in the line. One of these interrupters is shown in fig. 5; fig. 6 shows the interior of the device, and its connection with the bell and line. It will be seen that by pulling the line, the circuit is broken in the gas-tight interior of the interrupter, allowing the armature of the relay to fall back and close the bell circuit. It is claimed that sparking on the line wire is entirely eliminated, less battery power is required, signals can be given from any part of the line by simply pulling the line wire, the signals

Fig. 5.—G.E.C. Patent Interrupter.



a, Indicators or bells, relays, and push combinations; *b*, Local bell or indicator coils; *e*, Battery energising local bell circuit; *f*, Relay magnet coils; *g*, Line wire; *h*, Interrupters; *i*, Fixed contact; *k*, Movable eyebolt contact; *n*, Push button for breaking main circuit at signalling station; *x*, Battery supplying the normally closed main circuit.

Fig. 6.—Details of G.E.C. Mine Signalling System.

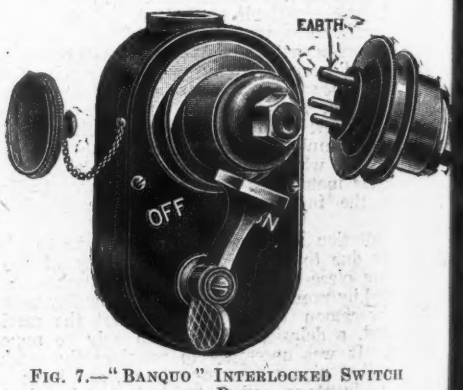


Fig. 7.—"Banquo" Interlocked Switch and Plug.

are positive and unaffected by dirt, &c., on the wire, troubles on the line are avoided by the use of a single line wire, and the system is extremely simple. If the line wire is broken, the bells ring continuously, and thus call attention immediately to the fact; if the line wire is earthed, the fault is easily traced, as signals can be given up to the fault, but not beyond it. The system appears to possess marked advantages for use in fiery mines.

"Girder" Machine-Lighting Fitting.

The great influence of suitable illumination on the output of industrial works is daily becoming more widely recognised. No single factor plays a more important part in promoting efficiency in production, due very largely to the avoidance of eye strain and benefit to the general health of the operative.

Messrs. Drake & Gorham, Ltd., 47, Spring Gardens, Manchester, have recently introduced a special type of fitting suitable for engineering shop requirements and similar work, which is designed to fulfil the necessary requirements—*i.e.*, to be strong

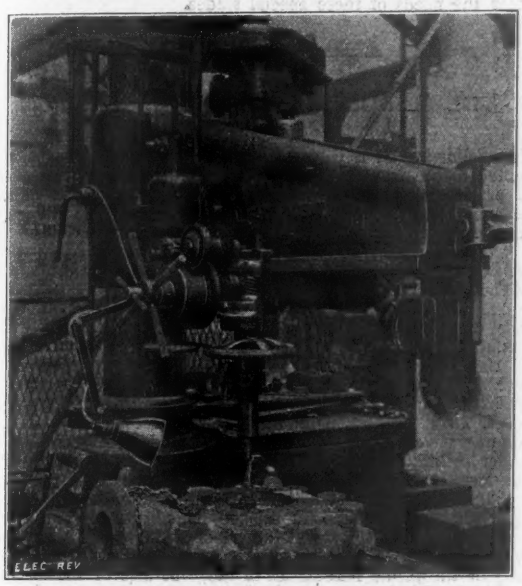


Fig. 8.—Girder Fitting attached to Drilling Machine.

and rigid, yet flexible and adjustable in any direction; easily fixed to a machine, for instance, and to direct the light on to the work, while at the same time shielding the source of light from the eyes of the operator.

Figs. 8 and 9 show the general construction of these fittings, in which ordinary wear can be taken up by means of a spanner,

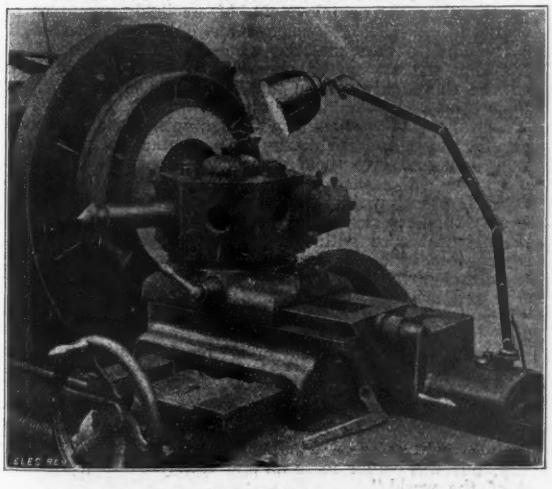


Fig. 9.—Girder Fitting Attached to Lathe.

standard bolts and nuts, with spring washers and double nuts at joints, being employed.

A variety of interchangeable bases is supplied, so that fittings can be fitted to machines of various types or on to the wall, &c.

In addition to the fittings, Messrs. Drake & Gorham are introducing, for use with them, low-voltage metal-filament lamps with static transformer or direct-current generator, as the case may be—an 8-watt low-voltage metal-filament lamp being ample for lighting purposes, if properly applied, and capable of superseding, probably, a 60-watt carbon lamp, such as usually employed in positions exposed to vibration and mechanical shock. The low-voltage metal lamp is practically as strong mechanically as the carbon lamp, and obviously saves energy. Two new type reflectors are being introduced for use with this fitting; for the low-voltage system a small shade is used to contain the small lamp. The larger shade for use on ordinary 100 or 200-volt lighting circuits is similar in construction, except that the lampholder is insulated from the shade by being screwed into an insulating bush fixed in the back of the shade. An insulating hood covers the projecting dome of the lampholder in cases where complete insulation is necessary. The new pattern shade enables a stronger mechanical construction to be employed, more suitable for rough works' use.

We understand that a patent has been applied for, for the "Girder" fitting.

INDUSTRIES AND MUNITIONS.

Last week we were only able to refer briefly to the deputation from the Federation of British Industries and other Manufacturing Associations to the Government, at the House of Commons, on March 13th. We give a full abstract of the proceedings below: Dr. Addison (Minister of Munitions) presided.

Mr. George Terrell, M.P., of the British Manufacturers' Association, who introduced the deputation, said that it comprised the Federation of British Industries, which had 347 members, and included an important number of associations each having their own membership: the Central Council Association of Controlled Firms, with a membership of 3,500 manufacturing firms; the Employers' Parliamentary Association, which had a membership of 2,500 manufacturing firms; and the British Manufacturers' Association, which had a membership of about 700 manufacturing firms. There was a total represented in these organisations of something like 8,000 or 9,000 manufacturing firms. The amount of the capital involved was something over two thousand million pounds, and the number of hands employed ran into several millions. Their object was not to find fault or to complain of mistakes, but to put facts before the Government showing the mistakes which had occurred in the past, and to submit practical suggestions for their avoidance in the future. They knew that they had to make sacrifices. They were prepared to make any sacrifice necessary for the common cause. But there were many sacrifices which they were called upon to make which were of no good to the country, which were simply a waste of time and waste of money, and it was to prevent the recurrence of waste of that kind that they came to ask for help. They knew that there had been enormous difficulty in the creation of the Ministry of Munitions. It had accomplished great things, and great credit was due to the many officials employed there. Men of the highest intelligence and knowledge in the business world were serving from patriotic motives, but among them there were gentlemen occupying important positions who, with every desire and enthusiasm to serve their country, were, probably through lack of experience and knowledge, making mistakes. The deputation was anxious that in the future mistakes should be avoided as much as possible. The Government required men for the Army and for munitions. The employers who had to produce munitions and other national requirements were struggling to obtain the greatest possible output from their factories. The Government wanted the output; they were always pressing for it. Therefore, it was necessary for the energies of works managers and others to be concentrated on their work, and not taken up unnecessarily with the filling up of forms, attending Tribunals and at the Ministry of Munitions, and doing other work of a similar kind. They suggested that if employers were taken into confidence and consulted in regard to the steps the Government considered it necessary to take they would probably be able to meet the requirements of the Government with the minimum interference of output. Mr. Terrell went on to say that what the deputation asked was that manufacturers, through their organisations, should be consulted in regard to any new orders or instructions which might be considered necessary by the Government for the regulation of labour, raw material, and manufactures. It meant simply that the Government should notify any changes or rules or regulations which they might desire to pass to the Federation of British Industries. The Federation would make inquiries for the whole trade of the country, find out which were the industries really affected, and get first-hand information which they would submit to the Government for their consideration. They asked to be allowed to gather the information, and to submit it for consideration before any definite action was taken of the kind which he had indicated in the cases to which he had referred. If the Government could see its way to adopt the suggestions a great deal of time would be saved, a great deal of waste would be avoided, and the employers would be able to show that they could render the Government very important and valuable work in the responsible duties they had to carry out.

Sir Vincent Caillard (Vickers, Ltd.) cited numerous instances in which closer co-ordination between the manufacturer and the Government would have had the effect of stimulating the output and removing friction.

In reply to these and other speeches, Dr. Addison, thanked the deputation for having put their case so clearly and dis-

tinctly, and expressed the regret of the First Lord of the Admiralty for being unable to meet them, but stated that he would be glad to confer with Mr. Chamberlain, Lord Derby, and himself on the general question which had been brought before them. For the most part, he was afraid that the department most concerned appeared to be the Ministry of Munitions, but he believed that some of their complaints were perhaps based on a little misunderstanding of some of the considerations involved. In the first place, he ought to thank them for bringing forward so few instances. He admitted that they had been compelled to interfere with trade all over the country. The fact that he saw before him gentlemen he had seen on so many previous occasions was, he thought, considerable proof that they had been frequently consulted. With regard to copper, aluminium, lead, steel, and so on, it was essential to preserve sufficient working stock in this country to make munitions. It was quite evident that the restrictions which had been imposed would, unfortunately, in a good many cases inflict serious harm on the trade, and the Government were only too glad to welcome any suggestion whereby that hardship could be minimised as much as possible. But they should not deceive themselves on this point. These things could not be done without causing harm. We should never get out of these difficulties so long as the war lasted, but what they wanted were business-like arrangements to deal with them. They must not blame the Ministry of Munitions, or the War Office, or the Admiralty, or the Shipping Controller. Nothing was more difficult, said Dr. Addison, than the issuing of the priority certificates. To protect our supplies we had to divide priority orders into various classes. Two or three gentlemen had complained that they could not get priority certificates for certain classes of work. The departments immediately concerned in keeping up the fighting forces were going to have the first cut off the joint. As to the general ground of complaint that the departments did not take employers into consultation often enough, they knew how urgent the business was, and, having regard to these times of emergency, he did not think that the deputation's suggestions as they stood really would quite work. They had in respect of the trade union organisations a very important and most valuable committee which they consulted on various questions affecting labour. If the various employers' organisations would be satisfied, the Ministry of Munitions, and he was quite sure his colleagues at the War Office, would be glad to consult with a standing committee of, say, three or four persons whom they could trust to speak in the name of those whom they represented when matters arose affecting new Orders and so on. He did not think it would be business to agree to anything which would mean sending all over the country to get all manner of people's ideas. It would simply result in a Babel of counsel, and the Government would never get anything done. The Government had to act quickly, and although it sometimes operated a little harshly the method they adopted was, they considered, the best. Quite recently he had appointed a small committee of business men whose business it was to advise the Priority Section of the Ministry of Munitions with respect to all orders, and so on, so as to occasion the minimum of hardship. He believed there were four gentlemen on that committee at present, and he would be very glad to afford that collection of employers' organisations the opportunity of appointing an additional one or two members. The gentlemen they appointed, he warned them, would have to attend to the work all day. It was not a case of dropping in now and then, because the cases requiring their attention were continually occurring, and it must be an understanding that anybody who was appointed must be prepared to spend his whole time at that work. They had between 1,000 and 1,500 applications every day, and he believed it would bring them to a nearer realisation of the Government's difficulties than perhaps some of them possessed at the present time, and might in that way have a wholesome effect. Let there be no misunderstanding. He did not want to have one committee, say, for the shipbuilders, another for the engineering employers, another for this, and another for that. It must be one committee to represent all concerned. That would be the only businesslike way of dealing with their complaints.

Mr. Neville Chamberlain (Director of National Service) said that it appeared to him that the discussion had really had very little reference to the department over which he presided. While he felt that it was extremely desirable that employers should be consulted upon matters in which their interests were concerned, he could see that, in war-time at any rate, there were a great many difficulties. They arose chiefly from the fact that there was not sufficient organisation among the employers themselves. In war they had to act quickly, and they simply could not afford to wait and consult all the interests concerned whenever they wanted to make an order. He desired to keep in touch with employers, and he was not only willing, but desirous of consulting anybody sufficiently representative of the employers. The essentials were that they should have a body which was always get-at-able. Questions arose at a moment's notice, and to get at people living in different parts of the country would mean several days' delay. Therefore, they must have a body domiciled in London, and representative of as many interests as possible. The representatives who came and consulted with them must be people of sufficient standing and able to speak without having to consult a lot of people behind them. Such a body would be of great assistance to the Government and of great use to the country. They would enable them to avoid mistakes which they might otherwise make, and do away with some of the friction which had occurred in the past. If the Federation of British Industries could supply such a body he should be glad to consult it.

Sir William Peat replied, expressing the thanks of the deputation. He said that a body created in the manner recommended by Dr. Addison might do a great deal to meet the difficulties which had arisen. But it could not do all that would be necessary, because when dealing with, say, shipbuilding, steel making, castings, or engineering, they were dealing with bodies entirely different from each other, and with interests entirely different from each other. Hence it would follow, it seemed to him, that it was desirable, if possible, that where their interests were affected some representatives, however small in number, should be co-opted to meet the needs of these special trades.

THE INDUSTRIES OF THE EMPIRE.

The following is a copy of the memorial which was presented to the Imperial War Cabinet, signed by 81 associations of producers and manufacturers representing, as far as can be estimated, about £1,000,000,000 of capital. The industries concerned are distributed throughout the Empire.

"We associate ourselves with the following principles which we believe now represent ideals appealing to the vast majority of the people of the Empire.

"1. That the deepened sense of our unity of interest in the face of national danger, as between various classes of the community, and as between the Dominions and territories of the Empire, must be recognised and maintained in all measures to be considered from the point of view of economic security and progress.

"2. That the first claim on Imperial statesmanship is that remunerative employment shall be made available for all under conditions that will crown with comfort and prosperity the freedom for which we are now working and fighting.

"3. That to this end the three great agencies of production, capital, labour, and science, should be systematically directed towards the development of the boundless resources of the Empire so that it may become more productive, not only of the prime necessaries of life, but also of the essential materials of industry and of all departments of manufacture.

"4. That the resolutions of the Paris Economic Conference provide a sound basis for national self-development, and for maintaining mutually advantageous and privileged commercial intercourse between the Allied Powers.

"5. That after the institution of such a system of reciprocal preferential arrangements as will give practical effect to the resolutions of the Paris Conference, which can best be settled in detail by conference with representative organised associations of manufacturers and producers, our next Imperial duty is to stimulate the employment of available resources of mechanical and chemical science for enhancing productive capacity, and so enriching the whole community.

"6. That the system of general and technical education should be thoroughly revised to afford to all classes equality of opportunity for talent and industry.

"7. That the state should, while facilitating general conditions, recognise and regularise the position of industrial organisations and give them additional responsibility for the efficient conduct of each section of industry. In conference with each other, with Labour, and with the Government, they may thus found a system of industrial security and progress in true accord with the spirit of British enterprise as being capable of continuous adjustment to varying circumstances, and giving opportunity for the exercise of individual energy and original endeavour.

"It is in the light of these principles that we believe an Imperial economic system can be constructed worthy of our vast natural resources, and of a manufacturing capacity greatly enhanced in volume and variety as the result of war demands. Further, we believe that a consistent policy aiming at the efficient and bounteous production of the wealth of the Empire by and for our own people will not only establish all British States on a higher plane of progress and prosperity, but will confer material and social advantages on the rest of the world."

The signatories to the memorial include the B.E.A.M.A., the British Engineers' Association, the Cable Makers' Association, and the Electrical Contractors' Association.

Holland.—The Dutch Customs authorities have recently given a decision to the effect that the value to be declared for Customs purposes of transformers, which are dutiable at 5 per cent. *ad valorem*, should include the value of the quantity of oil contained in the transformer, and forming a whole with this. The oil in that case need not be declared, and subject to duty separately.

WAR ITEMS.

Brighton Tramway "Group" Scheme.—The manager of the Brighton tramways has worked out an ingenious plan for releasing men employed on the Corporation tramways for military service by groups. There are 38 men on the tramways who hold certificates of conditional exemption. In anticipation of a review of the exemptions, the manager has prepared, and the Tramways Committee and the Military Representative have approved, a scheme by which the men will be called up by instalments according to fictitious ages arrived at on the basis of each man's actual age with the addition of one year for each child and one-third of his period of service. The "youngest" men, according to this scale, will go first. —*Times*.

U.S. and the War.—The New York financial correspondent of the *Times* states that at a conference of leading steel manufacturers it was agreed to sell to the Government plates and structural shapes at about 50 per cent. under market prices. The orders will be divided among the companies according to their capacity. A committee of manufacturers will take care of all Government requirements during the war, arranging prices and expediting production.

To be Wound Up.—The Board of Trade has ordered the following to be wound up:—

Tandem Smelting Co., Ltd., Christchurch Road, Merton Abbey, London, S.W. 2, smelters and assayers. Controller: B. D. Holroyd, 6, Great Winchester Street, E.C. 2.

Kroll & Co., Bayham Place, Camden Town, N.W., metal workers. Controller: R. B. Tyler, 1, Queen Victoria Street, E.C.

Trading with the Enemy.—The "London Gazette" for April 27th contains particulars of further persons and bodies, in the following countries, with whom trading is prohibited: Argentina, Brazil, Chile, Netherlands, Norway, Spain, &c.

Employment of Discharged Soldiers at Marylebone Electricity Works.—In the House of Commons, recently, Mr. Anderson asked the President of the Local Government Board whether he had received a communication from the Marylebone and District Trades and Labour Council in regard to the employment of wounded soldiers at less than a standard rate of wages by the electricity department of the Marylebone Borough Council; whether it was the view of his Department when discharged soldiers were employed by a local public body that their State pension should be taken into account in deciding what wages should be paid them; and, in view of the objections to such a practice, what steps he intended to take?

The Parliamentary Secretary to the Local Government Board (Mr. Hayes Fisher), in reply, said:—"I understand that a few disabled soldiers are employed by the electricity department of the St. Marylebone Borough Council on work which, notwithstanding their disability, they are able to perform, and that they are paid a fair and reasonable wage and given the benefit of the Council's schemes as to sick pay and superannuation. As my hon. friend is probably aware, a Trade Advisory Committee, consisting of an equal number of representatives of associations of employers and workpeople, has been formed jointly by the Minister of Labour and the War Pensions Statutory Committee to give advice upon questions relating to the training and employment of disabled sailors and soldiers as electricity sub-station attendants; and I am informed that this matter has been considered by the Committee, who have reported that the rates of wages which are being paid by the Council to the men in question have been determined without regard to their pension and are the same as the rates that were paid in pre-war time, with an additional war bonus of 2s. In reply to the latter part of the question, I may point out that the matter is not one in which the Local Government Board would be empowered to take any action."

Belgian General Electric.—According to the "Frankfurter Zeitung" of April 16th, quoted in the *Daily Mail* of April 25th, The General Electric Co. of Belgium, Ltd., branch of The General Electric Co., Ltd., London, is included in a list of British firms whose liquidation has been ordered under decree of the German Government by the administrative authorities acting under the Governor-General of Belgium.

Imperial Preference.—Mr. Bonar Law stated in the House of Commons last week that the Imperial War Cabinet had unanimously accepted the principle that each part of the Empire, having due regard to the interests of our Allies, should give specially favourable treatment and facilities to the produce and manufactures of other parts of the Empire. There was no intention to make any change during the war. The Prime Minister also referred to this matter as a definite part of future policy in his speech in the City last Friday.

Post Office Electricians' Clearance Certificates.—Three electricians temporarily employed by the Post Office, wiring the Glasgow Post Office, were only allowed to work 48 hours a week. If they were employed outside they could work for a 54-hour week and earn more—a great consideration in these days when everybody in their particular trade is wanted to work as long as he can. They accordingly applied to the Glasgow Munitions Tribunal for clearance certificates. The Post Office opposed, and said that the wages question was settled by a Select Committee which fixed 48 hours per week. The men said that their engagement was temporary and that the Committee sat before the war. The Sheriff asked why the men could not be allowed to work a 54-hour week with the Post Office, and the officials answered that they were working alongside others who had accepted the conditions. The Sheriff said it was strange for a Government committee to recommend a reduction of working hours when tradesmen generally were working extra time. The men wanted to work more time, and being only temporarily employed might be dismissed any day on a week's notice. It was unreasonable that they should be kept from doing work outside and from earning more pay if they wanted. The Select Committee's recommendations were made before the war. The Assessors concurred with him in the view that the clearance certificates should be granted.

Exports Prohibited from Other Countries.—The Supplement to the *Board of Trade Journal* of April 26th contains complete lists of articles which, according to the latest information received by the Board of Trade, are prohibited to be exported to various destinations from the Straits Settlements, Hong Kong, Nigeria, Gold Coast, Jamaica, Barbados, Trinidad and Tobago, and British Guiana.

Exemption Applications.—On Monday, at the Northampton Tribunal, Mr. J. T. Cameron, Corporation Tramways manager, appealed for several employés. Three months' open exemption was granted to the chief clerk, the armature winder, the senior cash clerk and the foreman painter, the V.T.C. B section condition being attached in respect of the two clerks.

At Dewsbury, F. Thompson (18), an electrical tester, passed A 4, said he was studying for an electrical examination and he would not be able to further attend the classes unless he passed. He was told that he would have two further medical examinations after he joined up, and his appeal was dismissed, but a month's grace was granted.

At Oxford, the Electric Co., Ltd., appealed for exemption for Mr. John F. W. Pierce (40), chief assistant engineer and mains superintendent, two engine fitters, turners and deputy shift engineers, two switchmen and superintendents of substations, and a shift stoker. For the company it was stated that since January three men referred for substitution had been released, and they were prepared to release a fourth if a substitute could be provided. Reasonable substitution could not be provided for the chief assistant engineer and the two deputy shift engineers, and the switchmen would be difficult to replace. The staff was cut down to its minimum, and any stoppage of supply would affect munition factories and hospitals. The Tribunal exempted Mr. Pierce, one deputy shift engineer, and the two switchmen for three months or until substitutes were found, and refused the other appeals, with a month's grace.

Reigate Tribunal has withdrawn conditional exemption held by C. W. Read (34), shift engineer at the Corporation Electricity Works, and given temporary exemption until July 24th.

At Taunton, the Taunton Electric Traction Co. appealed for V. L. Marshall (33), acting manager and traffic inspector, the only member of the staff liable for military service. He is responsible for five miles of live wire, and it was most important for the safety of the public that a competent man should be retained. He had been twice rejected, and was now passed for general service. The appeal was disallowed, 14 days' grace being granted.

Before the East Sussex Appeal Court, the Military appealed against exemption granted to an employé of a Brighton firm of electrical engineers. One of the partners said that 70 of their staff had joined up, and the man appealed against signed for munition work, but was left with them because the Ministry of Munitions recognised that he was doing work of exceptional importance. The firm was doing a great deal of electrical work in hospitals, and the man had been specially trained for it. The exemption was confirmed.

At Tonbridge, on April 24th, Mr. W. G. Gilbert (31, in Class C 1), electrical engineer, appealed for exemption on the ground of his numerous engagements on works of public utility, but he was refused exemption.

Conditional exemption has been granted to J. Burch, blacksmith, appealed for by Mr. Harvey, tramways manager at Ilford.

Southend-on-Sea Tribunal has granted until July 1st to a traffic inspector (35, in Class B 1), appealed for by the Corporation electricity department; and to the same period to an armature winder (35, in B 2), the only employé of this kind left with the Corporation.

At Oldham, Messrs. G. Buckley & Sons appealed for the man in charge of their electric motors, aged 30, and in Class A, but exemption was refused.

As Shrewsbury, Mr. G. H. Smallwood, electrical engineer, appealed for the retention of O. Landon, an apprentice, in Class C 2, and stated that he had a lot of Government contracts on hand. The Chairman said that Landon was not of much military value, and he would be given until October 1st.

LEGAL.

DOUGLAS *v.* CREASEY.

AT the West London County Court, on Monday, before Sir Lucius Selfe, Dr. Creasey, of Grafton House, Piccadilly, was sued by John Douglas, builder and decorator, of Exhibition Road, South Kensington, who claimed £12 15s. 2d., balance of account.

Mr. Tetlow represented the plaintiff, and Mr. Henn Collins was counsel for the defendant.

The plaintiff, it appeared, entered into a contract with Mr. Hamilton, agent for the landlord of the flat at Grafton House, to carry out certain decorative and electrical work for an inclusive sum of £117, to which was added a supplementary account for £6 7s. 8d. for extra electric lighting work. The contract contained a clause that the plaintiff was to "provide, where necessary, new plugs and switches to 24 points to be indicated by the lessee," and as Dr. Creasey required plugs and switches to be placed in such positions that a considerable amount of re-wiring was necessary, the plaintiff, who had executed other work for the doctor, included in his bill a charge of £12 15s. 2d. for the re-wiring. The doctor refused to pay this, urging that the work was included in the arrangement between the plaintiff and the landlord's agent.

For the plaintiff it was argued that the clause quoted meant that the lessee was entitled to choose the kind of switches and plugs he desired; not that he could choose any part of a room for them to be placed, unless he was prepared to pay for the extra wiring required.

His HONOUR gave judgment for the defendant, remarking that the only meaning he could see in the words was that the lessee was entitled to indicate the positions in which he wanted the switches and plugs fitted, and that the wires were to be carried to those points.

ELLIS *v.* BIRKETT.

AT the Southend County Court, last month, H. H. J. Ellis, through his father, sued Robert Birkett, borough electrical engineer, Southend, for £100 damages for alleged breach of apprenticeship indentures. There was also a cross-action for £50, said to be due under the indentures. For the plaintiff, it was stated that nothing was alleged against Mr. Birkett personally, but it was alleged that plaintiff had practically received no proper instruction whatever. After evidence had been heard, the case stood adjourned to May 11th.

BUSINESS NOTES.

Bankruptcy Proceedings.—A. B. CRAIG, merchant, 8, Well Street, Cripplegate, E.C.—The application of this debtor for an order of discharge came before Mr. Registrar Hope, on April 26th, at the London Bankruptcy Court. The Official Receiver reported that the debtor failed in November, 1915, with provable debts £25,437 and assets expected to produce £25,858. The latter included a claim to £50,654 against the Occidental Syndicate, estimated to yield £8,000, and the debtor's share interest in the company, which he anticipated would eventually bring in £30,000. The syndicate controlled the Sturgeon Falls (Canada) Electric Light and Power Co., Ltd., which was formed in 1898, and owned certain water-power rights which it had leased in an undeveloped condition to the Sturgeon Falls Pulp Co., and the latter concern had agreed to supply a certain amount of power and light to the Power Co. There had been considerable litigation in Canada in regard to the properties, and, in the opinion of the Official Receiver, the debtor's estimate of the realisable value of his assets was excessive and unwarranted. Up to the present time, the trustee (Mr. S. R. Worley) had realised only £1,082; and with regard to the debtor's interests in the Occidental Syndicate, they were very involved, and could not be realised until after the war. The application was opposed by the Official Receiver, on the ground that the debtor had brought on, or contributed to, his bankruptcy by rash and hazardous speculations. Mr. E. W. Hansell appeared in support of the application, and, after a lengthy hearing, the learned Registrar upheld the report, and imposed a suspension of three years. Order entered accordingly.

F. BROWN, electrician, 8, Stafford Street, Llanelly.—May 12th is the last day for the receipt of proofs for dividend. Trustee, Mr. H. W. Thomas, 4, Queen Street, Carmarthen.

E. W. BARTON WRIGHT, electrical therapeutic expert, Acton Park.—Composition of 5s. in the £, payable May 4th, at Official Receiver's office, 14, Bedford Row, W.C.

Auction Sale.—On Wednesday, May 9th, MESSRS. GODDARD & SMITH will offer for sale by auction the stock of electrical appliances and fittings, &c., of the Magnetic Waves Institute, 133 and 135, Oxford Street, W. Particulars appear in our advertisement pages.

Trade Announcement.—THE FELLOWS MAGNETO CO., LTD., of Park Royal, W., have, it is announced, acquired the whole stock and effects, including the machinery and plant, of the Mea Magneto Co., Ltd., which was recently put up for sale under the Enemy Trading Regulations.

Catalogues and Lists.—MESSRS WARD & GOLDSTONE, Sampson Works, Salford, Manchester.—Supplementary price list (No. 103) of 22 pages. This is an instalment of what would have been a large catalogue but for war conditions causing printing restrictions and price variations. It contains illustrated particulars and prices of a wide range of electrical lines which are in constant use, particularly in munition and similar factories. Large stocks of insulators of British manufacture are held and these are listed. Ironclad switches and fuses, lampholders, combined switches and plugs, distributing switchboards, hand lamps, watertight fittings, cables and flexibles, &c., are among the accessories and materials included.

MESSRS. LANDIS & GYR, LTD., Hampton Hill.—Supplementary price list of time limiters.

GENERAL ELECTRIC CO., LTD., 67, Queen Victoria Street, London, E.C.—Revised price lists (April, 1917) of Osram drawn-wire lamps—a four-page leaflet O.S. 2,110, and a folder O.S. 2,108.

MESSRS. WRIGHT & WOOD, LTD., Century Works, Halifax.—Catalogue of alternating and continuous-current motors and dynamos and control gear. It comprises a number of sectional lists, some of which have been recently revised. These lists deal respectively (giving specification and tabulated prices and particulars) with two and three-phase induction motors; two and three-phase alternators; two and three-phase crane motors; continuous-current motors; ditto starters; oil and air break starters, &c.

Spain.—Under the style of the Industrias de Cobre Electroliticos Sociedad Anonima, there has been formed at Barcelona a company for the making of seamless electrolytic copper tubes. The company owns certain foreign patents, and has lately purchased a large factory with up-to-date machinery equipment.

La Maquinaria-Hispano-Inglesa is the title of a new company formed in Madrid to continue the business of the firm of Morgan and Elliott, the sale of machinery and the carrying out of electric installations.

Liquidations.—C. H. BLUME, Western Road, Mitcham, varnish and enamel manufacturer.—The controller, Mr. J. W. Barrett, has applied for his release.

CLIMAX STOPPER AND EBONITE CO., LTD., Custom House, E.—The meeting of trade creditors summoned for May 2nd is postponed.

CROMPTON & CO., LTD. (registered in 1888).—A meeting is called for June 4th at Salisbury House, E.C., to hear an account of the winding up from the liquidator (Mr. E. Reeves). This, of course, does not relate to the existing company which was registered in 1913.

HEINRICH TRAUN & SONS.—The Controller, Mr. J. D. Pattullo, has applied for his release.

Wattmeter Charts.—The address of manufacturers of these charts is wanted. For particulars see our advertisement pages to-day.

The Tata Hydro-Electric Works.—We have received from MR. ALFRED DICKINSON, the consulting engineer, a brochure of some 60 pages, in which there appears a very fine set of half-tone pictures of the works, pipe lines, lakes, dams, ducts, power house, transmission lines, &c., of the Tata Hydro-Electric Power Supply Co. Interesting group photographs are given of eminent personages, directors and officials on the occasion of opening and other functions, also of a group of workers.

LIGHTING AND POWER NOTES.

Aberdeen.—LOAN SANCTION.—The Electricity Committee reports that the Secretary for Scotland has sanctioned loans for £40,000 for electricity purposes.—*Aberdeen Express.*

Blackpool.—PRICE INCREASE.—The Electricity Committee has decided to increase the flat rate for lighting purposes from 4d. to 4½d. per unit. For the maximum demand system, the charge is to be raised from 6d. and 2d., to 7d. and 2d. per unit, and for power purposes it is proposed that the rate should be 3½d. and 1d., as against 3d. and 1d. For heating and cooking the advance is from 1d. to 1½d. It is estimated that the new tariffs will represent an additional annual income of about £3,500, on the assumption that the consumption of electricity is equal to that of last year. There is a loss of £900 on the working of the undertaking for the past year, whilst in the previous year there was a net profit of £2,497.

Chester.—LOAN SANCTION.—The L.G.B. has informed the Council that it is prepared to sanction a loan of £4,500 for the proposed extension of electric cable to supply local works.

East Ham.—PRICE INCREASE.—The charges for current are to be increased to general consumers (including public lighting) by an additional 10 per cent. above pre-war charges, making a total increase of 20 per cent.; to the tramway undertaking by an additional charge of 5 per cent. above pre-war charges, making a total increase of 10 per cent. Such increases are to be first charged in respect of current supplied during the September quarter, 1917.

Edinburgh.—The Magistrates have decided that all theatres, picture houses, and other places of amusement shall, in their application for a new licence, or for renewal, have a certificate from the resident electrical engineer that the installation of electric light is in perfect order.

Exeter.—Street Lighting.—The Lighting Committee has appointed a Sub-Committee to consider the desirability as a war-time economy of discontinuing the lighting of the majority of the public lamps during May, June, July, and August.

Halifax.—Wages.—A Special Committee recommends the T.C. that the wages of all male employés (other than clerical staff), with the exception of men employed in the tramways department, be increased as from April 1st, 1917, to such an amount as will bring the wages, together with war bonus, to 8s. a week above the respective rates before the war; that the chairmen of the Gas, Highways and Health Committees, and the chairman or vice-chairman of the Tramways and Electricity Committee be appointed a Sub-Committee to consider the matter of overtime and Sunday payment, and that the Finance Committee be requested to endeavour to arrange a conference with representatives from the Corporations of Leeds, Bradford, Huddersfield and Halifax on the question of the wages of Corporation employés.

Ilford.—Loan Refusal.—The L.G.B. has again refused sanction to the borrowing of £10,000, for the purposes of the electricity undertaking. It suggests that the Council should consider the installation of converting plant at the Ley Street works. A Special Committee of the Council has instructed the electrical engineer, with the surveyor, to report and estimate on a temporary scheme for the utilisation of the steam at the refuse destructor, also as regards the suggestion made in the Board's letter.

London.—The Metropolitan Asylums Board is to purchase 12 electrical cooking mincers and mixers. It was reported at the meeting of the Board that these machines are made in the United States, and it is hoped that, in view of the saving in food and labour, facilities will be given for their importation. The cost before the war was about £70 per machine.

L.C.C.—The Finance Committee has agreed to loans of £1,000 to the Battersea B.C. and £13,000 to the St. Pancras B.C. for electricity purposes, subject to the Treasury approval.

Fulham.—The B.C. has increased the charges for electricity on the kw. system by the addition of ·0075d. per unit for each 6d. per ton that the average price of coal exceeds 13s. per ton during the period of charge.

The Committee has received an application from a local works for the supply of electricity, guaranteeing an annual payment of not less than £1,000 per annum.

St. Pancras.—Recently an application was made to the L.C.C. for sanction to borrow £5,000 for the purchase of a turbine, and its conversion. The L.C.C. questioned the necessity for the proposed expenditure at the present time. The Finance Committee of the B.C. is to communicate with the central authority, pointing out that the work has Government sanction. The staffs of the generating stations and mains department have applied for increased wages and a Special Committee is to be appointed to consider the matter.

Lambeth.—The General Purposes Committee of the B.C. has agreed to the proposed bulk supply arrangement between the South London Electric Supply Corporation and the County of London Co., whereby the latter will install and maintain for seven years the necessary converting plant, mains, &c., the former agreeing to take a minimum of 1,500,000 units for the year ending December 31st, 1918, and to pay a fixed charge of £1,500 per annum, and, in addition, a running charge of ·45d. per unit for the first million units and ·4d. for excess units, subject to certain provisos as to demand and to the price of coal. The agreement is subject to the approvals of the B. of T. and B.C.

Westminster.—The Works Committee of the City Council has adopted a proposal of the Westminster Electric Supply Corporation to substitute modern incandescent lamps for the existing arc lamps for public lighting in the Parish of St. George, Hanover Square. The adoption of the proposal will affect a saving of at least 2,000 tons of coal and 250,000 pairs of carbons per annum, and the services of 10 men. The cost of the alteration will be borne entirely by the company. When all the lamps (962) have been altered, the rebate to the Council will be at the rate of £2,650 per annum. The lamp proposed to be used is called the "Dula," and is stamped as "made in Holland." The company is to be asked to undertake that the material and appliances to be used shall not be of enemy make and origin.

On Monday the Standing Joint Committee of the London Borough Councils refused to agree with the total abolition of lighting during summer time, but agreed to make representation for a restricted, but uniform, system of lighting throughout London during May, June, and July.

Lowestoft.—Price Increase.—The Electricity Works Committee has recommended that the charges for electricity for lighting be increased by ½d. per unit, and for power and heating by 10 per cent.

Nelson.—A loss was incurred on the Council's electricity undertaking during the past year of £1,386.

Preston.—The T.C. has appointed a Committee to consider the question of the supply of electrical energy for power purposes in the town, and to receive the report of the borough electrical engineer, Mr. J. F. Simpson, on the subject.

Manchester.—Reduced Rate Relief.—The Corporation Electricity Committee has decided that, owing to the exceptional conditions, it will be able to make a grant of only £16,570 in relief of the rates, instead of £30,000, as a year ago. In addition, it will pay the whole of the income-tax charges, amounting to £36,000. This will represent an over-appropriation on the year's profit of £10,570, which will be withdrawn from the reserve fund.

Rawtenstall.—Year's Working.—The Electricity Committee reports a satisfactory year's working. The income is over £2,500 in excess of that of the previous year, whilst working costs and loan charges are £2,100 in excess. The surplus amounts to £2,207, and will be utilised in payment of capital expenditure for which no borrowing powers have been obtained. The Committee is committed to an expenditure of about £4,800 out of these surpluses, to be met within two years.

Rochdale.—Year's Working.—The troubles which the Corporation electricity works have passed through during the past year are reflected in the state of the finances, though the deficit is larger than most people expected. Although the total income of £62,035 showed an increase of £10,727, there is a deficit on the year's working of £13,430. Working expenses reached the high figure of £54,574, an increase of £24,190. On coal, coke and removal of ashes the expenditure was £32,594, or £13,894 more; repairs and maintenance, £9,450, showed an increase of £6,974; wages have increased by £1,243, and there is an advance of £250 on water and engine-room stores. These items, under the heading of generation, absorb £47,000, or nearly £22,700 more than a year ago. The gross trading profit is £7,461, but this is wiped out, and the large net deficit left, as interest and sinking fund charges amount to £20,464, against £17,686 last year, and there is £767 for half-wages to men on service, and war bonuses. The Committee has decided to take £7,395 from the reserve fund—the whole of the fund—and to carry forward the remaining £6,035 as a debit balance. A year ago there was a surplus of £2,537, and the previous year a loss of £330. The number of units generated last year was 16,500,000, an increase of 3½ millions, and the number sold 14,809,985, an increase of over 3 millions. The total capital account is £241,721—£14,047 having been spent during the year; loans repaid amount to £22,119, including £1,200; depreciation stands at £12,703, an advance of £2,417, and the sinking fund has been increased by £9,302 to £44,316.

Rotherham.—Year's Surplus.—There was a net profit of £5,324 on the working of the Corporation electricity undertaking for the past year, as against a profit of £7,585 for the previous year.

Salford.—Proposed Loan.—It is proposed to obtain sanction for the borrowing of £8,000 to cover the cost of supplying energy to the Manchester Ship Canal Co.

Southend-on-Sea.—Proposed Loan.—The T.C. has decided to apply to the L.G.B. for sanction to the borrowing of £45,520 for additional plant, &c., at the electricity works.

Stowmarket.—Price Increase.—The Suffolk Electricity Supply Co. has notified its consumers that, from May 1st, the price of current will be increased from 8d. to 10d. per unit.

Surbiton.—Price Increase.—Messrs. Callender have informed the U.D.C. that the price of current for lighting is to be increased to the maximum of 8d. per unit for a year. Sir John Snell has informed the Council that existing conditions justify the increase.

Todmorden.—Proposed Loan.—The T.C. has decided to apply to the L.G.B. for sanction to the borrowing of £10,000 for new generating plant for the electricity works.

West Ham.—Local Authorities and B. of T. Committee.—The Electricity Committee has passed the following resolution, a copy of which is to be forwarded to the President of the Board of Trade and to the various local authorities owning electrical undertakings throughout the country:—"That we are of opinion, having regard to the important part at present played by local authorities in the supply of electrical energy, and the extensive character of their capital commitments in relation thereto, that local authorities owning electricity undertakings are inadequately represented on the Committee appointed by the President of the Board of Trade to consider and report on the future supply of electrical power for all classes of consumers in the United Kingdom, and strongly urge upon the President of the Board of Trade the necessity of increased representation being given to such authorities."

Whitehaven.—The T.C. has decided to take two premium-free pupils at the electricity station, the candidates to be selected and recommended by the Borough Education Committee.

TRAMWAY and RAILWAY NOTES.

Belfast.—At a special meeting of the Corporation, it was decided to shorten the tramway stages and increase the fares. Nothing was done at the meeting with regard to the new electrical station which is to be built at the Queen's Island.

Blackburn.—Year's Working.—The annual report of Corporation tramways shows a loss on the year's working of £2,439, compared with a profit in the preceding 12 months of £1,756. The number of passengers carried was 11,862,343, which was 383,808 fewer than in the year before. The cash takings were £63,318, which was £1,060 below the figure for the previous year. Two hundred and five men from this department have joined the Forces; 10 have been killed or died of wounds, and one has won the D.C.M. At present, 12 females are acting as drivers, two as ticket inspectors, and six in other branches of the department. "They have shown," states Mr. Cowell, the manager, "great keenness and aptitude for the work, and the utmost good feeling prevails between male and female employés. The male employés deserve credit for the whole-hearted manner in which they undertook to initiate the females into the duties."

Blackpool.—The Tramway Committee has adjourned an application for increased wages.

Bolton.—The Tramways Committee has declined to consider a request by the Tramway Workers' Association for an advance in wages of 10s. per week.

Bournemouth.—Year's Working.—The annual report of the Corporation Tramways for the year ended March 31st last shows that nearly 18 million passengers were carried, being half a million more than in any previous year, though the car-mileage was 1,634,000, a decrease of 36,000. The net profit was £16,307, of which £3,000 has been allotted to the rates. Mr. Bulfin, the general manager, states that during the past six years the total profits of the tramways have amounted to over £66,000, or an average of over £11,000 per annum. Some £20,000 of this amount has been spent on the reconstruction and doubling of the lines in the Holdenhurst, Charminster, and Wimborne Roads and Winton, and the renewals fund will now stand at some £24,000, the reserve fund at over £5,000, and the working balance at close on £6,000.

Continental.—Germany.—A tax on the traffic receipts of privately owned railways and electric tramways and railways has been introduced. In those cases, however, where the cost of construction has exceeded £100,000 per km. the Federal Council is authorised to exempt these particular undertakings from the impost. Among the exemptions is the Berlin Elevated and Underground Railway Co., the chairman of which recently stated that the expenditure on this railway has amounted approximately to £250,000 per km.

Spain.—The railway company, "Caminos de Hierro del Norte de Espana," has decided to convert from steam to electric traction its line from Madrid to Gijon and the Port of Pajares, a distance of 62 km., and is prepared, up to June 15th this year, to receive tenders for its construction and equipment. The company's head office is at Madrid.

Doncaster.—It is understood that the Corporation is to advance the tramway fares on the Bentley route, so as to bring them into line with the other routes of the town. The Bentley route is the cheapest to the traveller and the most expensive to maintain.

East Ham.—The lease of the section of the Barking Council's tramways, which expires on May 31st, 1917, is to be renewed for a period of three years.

Edinburgh.—The Admiralty will support the Corporation in any application for a Provisional Order or Bill for a tramway to South Queensferry, provided there is no actual construction carried out during the war.

L. & Y. Railway Electrification.—It is stated on good authority that the principle of the electrification of the Manchester and Oldham line of the Lancashire and Yorkshire Railway, as far as Oldham, has been fully accepted by the company, as the result of the excellent results experienced on the Manchester to Bury section. Only the difficulties of war time have prevented the taking in hand of the work of equipping the line for electric traction.

London.—The London Electric Railways Co. has applied for an extension of time in which to extend the Charing Cross-Golder's Green line through Hendon to Edgware.

L.C.C.—The chairman of the Finance Committee, Sir George Goldie, in submitting the annual estimates, stated the Council's tramways had done better than expected, as instead of an anticipated deficiency of £74,000, a surplus of about £7,000 would result. Since the outbreak of war employés' wages had increased by £154,000 per annum, and war service allowances amounted to £114,300 per annum, and it was evident that the fares fixed before the war were inadequate to meet the additional expense.

The current estimates showed a probable deficiency in net revenue account of £89,402, and a call would have to be made on the already depleted renewals fund, unless means were devised for overcoming the adverse balance. He was not aware of any desire to adjust fares in order to contribute to the relief of the rates, but, on the other hand, it was generally agreed that the undertaking should involve no burden on the ratepayers. In the discussion which followed, it was suggested that a Committee on Reconstruction should be formed, but it was pointed out that the present Standing Committees were all doing something now in that direction.

The Highways Committee of the L.C.C. has, during the three months ended March 31st, 1917, settled 894 claims against the Council in respect of accidents arising in connection with the tramways, amounting to £7,624. In 24 other cases, actions were brought against the Council; in seven of these, an adverse verdict was given, and £642 and costs had to be paid; 11 actions resulted in the Council's favour, and six were withdrawn; £526 was received by the Council in respect of damage to tramway property.

The B. of T. has further extended the time for 12 months (to August, 1918) for the construction of certain tramways authorised in 1909-10 and 1914.

Rawtenstall.—The tramway undertaking requires £3,000 from the rates for the coming year, which is £1,000 in excess of the amount required last year. The receipts from passengers are over £1,300 more than in the previous year, and out of the rate in aid (£2,000) £1,734 is utilised to clear the loss for the year.

Southport.—The Tramway Committee has refused an application for a 10s. per week increase in wages.

U.S.A.—Electric Vehicle Revenue.—According to a recent estimate, the revenue of the electric lighting undertakings in the United States from the charging of the batteries of electric motor vehicles amounts to at least £720,000 per annum.

TELEGRAPH and TELEPHONE NOTES.

Post Office Staff Bonus.—A further war bonus to Post Office employés is granted in the first award issued by the Conciliation and Arbitration Board for Government Employés recently constituted by the Government. Including the previous war bonus, the general effect of the award is that adult permanent postal employés will become entitled, as from January 1st last, to a temporary war bonus at the following rates:—

Rate of pay.	Per week—Men.	Per week—Women.
30s. a week or under	9s.	6s.
Between 30s. and 40s. a week	8s.	5s.
Between 40s. and 60s. a week	7s.	4s. 6d.
Between 60s. a week and £250 per annum ...	5s.	3s. 6d.

—*Daily Telegraph.*

The "Heterodyne" Receiver.—On April 2nd, Judge Mayer, of the United District Court for the Southern District of New York, handed down an opinion in the suit of the receivers of the National Electric Signalling Co. *v.* the Atlantic Communication Co., in which he found for the plaintiffs. This suit was based upon a charge of infringement of United States letters patent 1,050,728 and 1,050,441, being respectively for the method and apparatus employed in a receiving station of a radio-telegraph system. These patents, issued January 14th, 1913, cover the invention known to the art generally as the "heterodyne," or beats, method of receiving radio-telegraph signals.

For receiving signals from a transmitting station in which the radiations are continuous, it is necessary to utilise at the receiving station some means of rendering these signals audible. Continuous waves, such as are sent from Nauen, Germany, for instance, having a frequency of approximately 30,000 cycles per second, are above the range of audibility, and cannot be used directly to operate a telephone. The "heterodyne" method of rendering these signals audible consists of producing another set of oscillations, at the receiving station, of a frequency slightly different from that of the incoming signals, and combining these local oscillations with the incoming oscillations in such a way as to compound their effects and produce "beats." These beats give a signal within the range of audibility, and thus make intelligible the incoming signals. The local oscillations continue of uniform strength all the time, but beats, of course, are produced only during the time of existence of the incoming signals, and hence the periods of sound and silence employed in forming the dots and dashes are indicated by the pitch of the particular tone. This is generally chosen of a frequency approximating to 1,000, so that in the example cited, with Nauen transmitting at 33,000 cycles, the local oscillations being 32,000 or 34,000, the beat frequency would be 1,000 per second, and would give a resulting high-pitched, clear musical tone.

The Court found that Reginald A. Fessenden, the inventor of this system, had produced an invention of great merit, and that the prior art cited by the defendants as anticipating the Fessenden invention had failed to teach the art anything in respect of the use of beats.

The Court also stated that Fessenden or his company, the National Electric Signalling Co., were the only ones to teach the art anything of value of this method of operation between the

date of application of his original patent in 1902 and the date of applications for the patents in suit, 1905.

The "heterodyne," or beats, method of receiving is the one that is now commonly used by practically all stations receiving signals from transmitting stations employing sustained waves.—*T. and T. Age.*

United States.—The new directory of the New York Telephone Co. contains 410,000 names. It has 948 pages, and 712,000 copies have been distributed. During the year 1916, 415 tons of silver and nickel coins were collected from the coin-box telephones in New York City.

The Government has availed itself of the offer of the Marconi Wireless Telegraph Co. of America, placing the staff and stations at its service, and has taken over for the period of the war, not only the Marconi stations, but all other radio stations, for military purposes. The eligible operators will be enrolled in the Government service. Stations not required will be closed. The trans-Pacific stations will continue handling commercial traffic, but under Government supervision. No ship traffic will be permitted on the Atlantic and Gulf coasts and the Great Lakes, excepting for the Government, but it will continue for the present on the Pacific. Trans-Atlantic traffic *viâ* Glace Bay will not be disturbed.

The War Department has taken over the control of all telegraph and telephone lines, and the Navy Department has taken control of the cables. Henceforth only messages passed by the American censor will be transmitted abroad.

Wireless Telegraph School.—At the Newcastle Rotary Club, last week, Mr. W. D. Owen, the recently appointed chief of the Municipal Wireless School at Rutherford College, Newcastle, gave an interesting paper on "Wireless Telegraphy." He stated that at present there was a great dearth of operators, and the demand greatly exceeded the supply. This trouble was intensified by the fact that the training of operators was left almost entirely to commercial schools. He confidently predicted that the Municipal Wireless School of Newcastle would eventually be recognised as the finest in the kingdom. The North of England Shipowners' Association had generously subscribed £2,000 towards the installation, and thus the school was able to provide the most complete equipment possessed by any wireless college in the world. The Marconi system, the Poulsen system, and the Telefunken system were to be fitted. Ships taken from the Germans would have German installations on board, and someone would have to operate them; that was why they were teaching the German system in addition to others. All men started as assistant operators, with the honorary rank of junior officer. The starting salary was £1 a week with all found, and this salary automatically increased year by year until it reached £2 15s. per week, plus keep. A man who had not qualified for a higher position by that time was being overpaid. Coast station appointments were open to suitable men, but were only offered to men who could carry responsibility in wireless; as in most other businesses, the trouble was not in finding higher positions for g od men, but in finding good men for the higher positions.—*Newcastle Chronicle.*

CONTRACTS OPEN and CLOSED.

OPEN.

Farnborough (Hants).—May 7th. 10-B.H.P. semi-enclosed protected-type motor, with direct-driven 6-in. Stereophagus or removable disk type centrifugal pump, with pipes and accessories, for the U.D.C. Mr. J. E. Hargreaves, Surveyor.

Manchester.—May 11th. Electricity Committee. Stuart Street generating station. (*a*) One hydraulic accumulator and electrically driven ram pump, (*b*) coal conveying plant. Mr. F. E. Hughes, Secretary, Electricity Department.

Sheffield.—May 8th. Tramways and Motors Committee. Carbon-filament lamps for tramcar lighting, for 12 months. See "Official Notices" April 27th.

Spain.—The municipal authorities of Torrelaguna (Province of Madrid) have just invited tenders for the concession for the electric lighting of the town during a period of five years.

Warrington.—May 22nd. Electricity and Tramways Committee. Underfeed mechanical stoker. See "Official Notices" to-day.

Wolverhampton.—May 4th. Electricity Committee. 5,000-KW. turbo-alternator, water-tube boilers, economisers, and induced-draught plant, and mechanical stokers. See "Official Notices" April 27th.

CLOSED.

Blackpool.—Electricity Committee :—

Stoker.—Underfeed Stoker Co., Ltd.
Cast-iron pipes for cooling-tower extensions.—Stanton Ironworks Co.

Derby.—T.C. Accepted tenders :—

Edgar Allen & Co.—Tramway points, £337.
W. Rickard, Ltd.—Cable, £523.
Newton Bros., Ltd.—Motors, £525.

Glasgow.—Corporation. The E.C. recommends the acceptance of the tender of the British Westinghouse Co. for one turbo-alternator set, &c., for £91,564, and that of Messrs. Fraser and Chalmers for another set for £94,678.

Halifax.—Corporation. For the electricity works :—

Babcock & Wilcox, Ltd.—One water-tube boiler, superheater, chain-grate stokers, &c., £5,140.
E. Green & Son.—Fuel economiser of 320 tubes, £882.
Musgrave & Co., Ltd.—Induced draught fan, £200.

Hull.—Corporation. Cooling towers :—

Davenport Engineering Co., Ltd. ..	(accepted)	£5,100
Premier Cooler and Engineering Co., Ltd.		5,240
Lancashire Water Cooler Co., Ltd.		5,373

London.—L.C.C.—The Highways Committee has received the following tenders for high and low-tension cables in connection with the additional supply of power for the Woolwich district :—

Western Elec. Co., Ltd.	(accepted)	£24,922
Siemens Bros. & Co., Ltd.		25,799
Brit. Ins. and Helsby Cables, Ltd.		26,493

The general manager's estimate was £25,000.

The undermentioned tenders were received for H.T. switchgear for Greenwich generating station and Woolwich sub-station :—

A. Reyrolle & Co., Ltd.	£2,000
B.T.H. Co., Ltd.	2,990

The Committee has accepted the lowest tender, subject to certain modifications in the machinery to be supplied, which has increased the amount of the tender to £2,597. The general manager's estimate was £2,500.

The Highways Committee has purchased about £34,000 tons of coal for use at Greenwich generating station, at a cost of about £57,000, during the quarter ended March 1st, 1917 :—

The following tenders were received for alteration to the switchboard gallery at the Greenwich generating station :—

W. Downs, Ltd.	(accepted)	£361
C. Wall, Ltd.		433

The following tenders have been accepted for the supply of tramway equipment, &c., 1916-17, Class T 6 B :—

Cotton-covered copper wire.—Midland Electric Wire Co., Ltd. (items 1, 2, and 3), approximately £1,257; London Electric Wire Co. and Smiths, Ltd. (items 4, 5, and 6), approximately £1,041.

Supply of tramways equipment, &c., 1917-18. Class T 1.—Electrical equipment (motor and generator) spares :—

British Westinghouse E. and M. Co., Ltd. items 1 to 7, 8 (50 per cent. of estimated quantity), 10 to 17, 24; A. Clare & Co., items 9 (b), 19 (b), 25 (b); Dick, Kerr & Co., Ltd., items 20 to 23, 26 to 30; Manchester Armature Repair Co., Ltd., 8 (50 per cent. of estimated quantity), 18, 31 (six months only).

Class T 2.—Electrical equipment, controller, circuit breaker, and other switch, &c., details and magnetic brake spares :—

British Westinghouse E. and M. Co., Ltd., items 1 to 17, 20 to 44; Dick, Kerr & Co., Ltd., items 18, 19.

Class 3.—Contact fingers and parts, segments :—

British Westinghouse E. and M. Co., Ltd., items 1, 12, 21, 26, 32, 34, 37, 38, 40, 45, 47, 48; Dick, Kerr & Co., Ltd., items 42, 44; E. Showell, & Sons, Ltd., 2 to 8, 10 to 11, 13 to 20, 22 to 25, 27 to 31, 33, 35, 36, 39, 41, 49; Tramways Supplies, Ltd., 9, 43, 46 (six months only).

Class T 6.—Electric cable, fuse wire, and cotton-covered copper wire :—

Midland Electric Wire Co., Ltd.—Items 1, 6, 9, 10, 11 (six months only).
Liverpool Electric Cable Co., Ltd.—Items 2, 4 (six months only).
Callender's Cable and Construction Co., Ltd.—Item 3.
Hooper's Telegraph and India-Rubber Works, Ltd.—Item 4.
London Electric Wire Co. & Smiths, Ltd.—Items 5 to 10 (for six months only).
British Insulated and Helsby Cables.—7, 8, 11.

Class T 10.—Moulded insulators (other than rubber) :—

British Westinghouse Electric and Manufacturing Co., Ltd.—Item 2.
Litholite, Ltd.—Items 3 to 22.
Woodite Co.—Item 23.

Class T 12.—Mica and micanite :—

Micanite and Insulators Co., Ltd.—Items 1, 2 (six months only).

Class T 13.—Insulators and porcelains for electrical track-work :—

Bullers, Ltd.—Item 1.
Gaskell & Grevett.—Item 2 (six months only).
Doulton & Co.—Item 2, for 2,000.

Class T 26.—Brake shoes :—

Pease & Partners.—Items 1 to 3.

Steel tires for tramcars :—

1,500 driving wheel tires, £4,875; 750 pony wheel tires, £2,334.—Messrs. H. Bessemer & Co., Ltd.

Manchester.—Electricity Committee. Accepted tenders :

Driving chains and wheels for cooling towers.—Hans Renold, Ltd.
High-pressure steam valves.—J. Hopkinson & Co., Ltd.
Cables.—Pirelli General Cable Works, Ltd.; British Ins. and Helsby Cables, Ltd.
Turbo-alternator and condensing plant for Stuart Street station.—Richardsons, Westgarth & Co., Ltd. Sub-contractors: Alternator, British Westinghouse E. and M. Co., Ltd.; motors and pumps, Mather & Platt, Ltd.; oil coolers, Birmingham Condenser Co.
Steel forgings.—Sir W. G. Armstrong, Whitworth & Co., Ltd.
Cast-iron pipework for cooling towers.—Aiton & Co., Ltd.

Salford.—T.C. :—

British Westinghouse Co., Ltd.—300-KW. rotary converter and transformer, for sub-station to be erected by Manchester Ship Canal Co. at Irwell Park Wharf, Eccles, £1,465; traction metal-filament lamps, &c., £568.
New Conveyor Co., Ltd.—600 steel trays, for coal conveyor plant at the electricity station, Frederick Road, £253.

Walthamstow.—U.D.C. Custodis, Ltd., £1,143; chimney at the electricity works.

West Ham.—The T.C. received applications for specifications for a boiler from Messrs. John Thompson, Ltd. (specification returned, no tenders sent in); Stirling Boiler Co., Ltd., and Messrs. Babcock & Wilcox, Ltd. The last-mentioned firm offered a marine type boiler identical with last two installed in the new boiler house, a few modifications in detail only being introduced as the result of recent practice. The Electricity Committee has accepted the tender of Messrs. Babcock & Wilcox (the lower received), at £10,734.

FORTHCOMING EVENTS.

Junior Institution of Engineers.—Friday, May 4th. At 7.30 p.m. At 39, Victoria Street, S.W. Paper on "Pneumatic Tubes," by Mr. H. E. Cosgreave.

Royal Institution of Great Britain.—Saturdays, May 5th and 12th. At 3 p.m. At Albemarle Street, Piccadilly, W. Lectures on "The Electrical Properties of Gases," by Prof. Sir J. J. Thomson, Pres.R.S.
Friday, May 11th. At 5.30 p.m. At Albemarle Street, Piccadilly, W. Lecture on "Radioactive Haloes," by Prof. J. Joly, F.R.S.

Chief Technical Assistants' Association.—Saturday, May 5th. At 3 p.m. At the Tavistock Hotel, Covent Garden. Discussion on "The Distribution and Transmission of Electrical Energy."

Society of Engineers.—Monday, May 7th. At 5.30 p.m. At Burlington House, Piccadilly, W. Paper on "The Goods Clearing House System," by Lord Headley.

Royal Society of Arts.—Monday, May 7th. At 4.30 p.m. At John Street, Adelphi, W.C. Howard Lecture: "The National Shortage of Iron Ore Supplies: Oversea Iron Fields which Supply the British Market," by Prof. W. G. Fearnsides.
Wednesday, May 9th. At 4.30 p.m. Paper on "Works Organisation and Efficiency," by Prof. W. Ripper.

Institution of Civil Engineers of Ireland.—Monday, May 7th. At 8 p.m. At 35, Dawson Street, Dublin. Ordinary meeting.

Association of Supervising Electricians.—Tuesday, May 8th. At 7.15 p.m. At St. Bride's Institute, Bride Lane, E.C. Paper on "Motor Control Gear," by Mr. J. T. Mould.

Salford Technical and Engineering Association.—Saturday, May 12th. Visit to Messrs. H. Wallwork & Co.'s works, Manchester.

NOTES.

Foreign Trade.—THE MARCH FIGURES.—The official returns of imports and exports during last month contain the following electrical and machinery figures:—

	March, 1917.	*Inc. or dec.*	*Three months*, 1917. *Inc. or dec.*
IMPORTS.			
Electrical goods, &c. ...	135,394	+ 19,985	+ 87,981
Machinery	668,790	− 16,717	− 103,875
EXPORTS.			
Electrical goods ...	303,771	− 24,402	+ 39,051
Machinery	1,868,783	+ 444,643	+ 1,236,444

Volunteer Notes.—FIRST LONDON ENGINEER VOLUNTEERS.—Headquarters: Balderton Street, Oxford Street, W.

Orders for the Week, by Lieut.-Colonel Clay, V.D., Commanding:—
Monday, May 7th.—Technical for No. 3 Company, Right Half Company, at Regency Street. Drill No. 3 Company, Left Half Company. Signalling Class.
Tuesday, May 8th.—Lecture, 6.30. Physical drill and bayonet fighting, 7.30 to 8.30.
Wednesday. May 9th.—Drill, No. 1 Company, Half Company, 6.15.
Thursday, May 10th.—Drill No. 2 Company, Left Half Company. Ambulance Class by M.O., 6.30. Signalling Class.
Friday, May 11th.—Technical for No. 3 Company, Left Half Company, Regency Street. Drill No. 3 Company, Right Half Company. Recruits' Drill, 6.30—8.30.
Saturday, May 12th.—N.C.O 's Class, 2.30. Examination by Adjutant and Assistant Adjutant.
Sunday, May 13th.—Special work at Bombing School. Parade, Clapham Common Station (City and S.L. Tube Railway), 9.45 a.m.
Armlets.—Armlets must be worn at all plain clothes' parades.
(By order), MACLEOD YEARSLEY, *Captain and Adjutant.*

Engineering Wages.—Speaking at the annual meeting of Fairbairn, Lawson, Combe, Barbour, Ltd., last week, Mr. J. Campbell Inglis (the chairman) gave details of the advances in wages for various kinds of engineering labour employed by the company. He said that their wage bill for the three branches for the year 1916 showed an increase of more than £31,000 over the 1914 figures, and that the total for 1917 would be over £80,000 in excess of the 1914 figures. The advances were all imposed upon them by the Committee on Production after hearing representatives of the Unions and of the Employers' Federation. The special difficulties of their trade had been put before the Committee most forcibly. Nevertheless, these advances had been given, and the question of the ability of the employer to afford them seemed to have been given quite a back place. It was the duty of employers to take all the steps possible to cheapen and facilitate the process of output. The board had this point of view constantly before them, and during the present trying time they had all had in mind the making of adequate preparations for coping economically and efficiently with the rush of work they anticipated when the war was over and their men came back. With regard to the cost of materials, it was one of the factors by which they were restricted in the making of profits. They had in their business to work by contracts made a considerable time in advance of the actual execution of the work. The result was that, in cases like the present, when there were rising rates of labour and materials, they were under a considerable handicap.

Electric Light Switching.—We have received from Messrs. A. P. Lundberg & Sons, 477-489, Liverpool Road, Holloway, London, N., 7, a copy of a new Advanced-Grade Exam. Paper which they will be pleased to send to all who desire to tackle this stage of the subject. A glance through the problems shows that they are all of quite a practical nature, and also that special tumbler switches have many other uses besides those connected with lamp circuits. Thus there is an application for ensuring the release of a motor-starting rheostat, one for starting and braking the motor of a small lathe, one or two relating to heaters, one for a magnetic chuck, and others of a similarly varied nature. The problems relating to lighting circuits are, nevertheless, by no means the least interesting. The firm's examiner, Mr. W. Perren Maycock, M.I.E.E., is to be congratulated on having put together such an illuminating set of problems; those who have not tried their hand at this game will find it an absorbing pastime, as well as a useful study. We reproduce a couple of easy ones:—

7. A voltmeter may be so connected through two two-way-off switches to a low-pressure three-phase line, that it may be put across any two of the three mains, or be entirely isolated therefrom. (*a*) Make a diagram of the connections, and show that the arrangement is foolproof; (*b*) show how two similar switches may be used for connecting one side of a voltmeter to either phase of a three-phase, four-wire system, the other side of the voltmeter being permanently connected to the neutral.

14. A ½-H.P. shunt motor driving a small lathe is required to be frequently started and stopped, the stopping to be very quick, as is necessary for expedition in certain kinds of work. Sketch a tumbler-switch control that will give electric braking, it being assumed that the field-winding of the motor can be left permanently in circuit while the lathe is in use.

British Science Guild.—The annual meeting of the Guild was held at the Mansion House on Monday last, the Lord Mayor presiding. Sir W. Mather announced that it was proposed to raise a sum of £100,000 to found Ramsay Fellowships for chemists and a laboratory at University College, in memory of Sir William Ramsay.

Lord Sydenham, the new president, read an address on "National Reconstruction," in which he advocated the application of scientific method not only to our industries, but also to every phase of public life. He referred to the waste and misuse of our resources which had been made evident by the war, and pointed out that great economies of fuel could be effected, and the injury done to the national welfare by negligence in the past could be alleviated by the adoption of a wiser policy in the future. New industries must be created and old ones developed; the resources of the Empire were almost inexhaustible, and we had only begun to make use of them. The lessons taught by the war should be laid to heart, so that when peace returned the ignorance and abuses of the past should be avoided and sound methods of government should take their place.

Mr. H. A. L. Fisher, Minister of Education, said that we must look to the co-operation of science, industry, and education for the economic and industrial reconstruction that would follow the war. The practical teaching of science in our schools was as efficient as in the schools of Germany and France, but it had not awakened the interest of the general mass of the population, and he hoped that the Committee which was investigating scientific teaching would be able to put forward improved methods.

With regard to industrial reorganisation, he held that we ought to think on a larger scale, and organise our businesses on scientific lines. Already the Imperial Trust for Scientific and Industrial Research was engaged upon many problems of urgent importance. There was no antagonism between general teaching in citizenship and technical training; a form of scientific training conceived on broad lines might have the same influence on mind and character as used to be ascribed to the older discipline.

Mr. H. G. Wells said that education was the fundamental question; science was neglected, and the Greek shibboleth barred the way to the study of science and history. Classical teaching stuck like a cancer in the time table, and must be cut out.

The Committee on Production.—The *Times* states that the completion of the agreement for general advances has enabled Sir George Askwith to retire from the Committee on Production, and to devote his whole attention to conciliation work. In order to expedite the hearing and settlement of cases, the Committee will in future be divided into two Panels. The Committee will meet at 5, Old Palace Yard, and the secretary will be Mr. H. J. Wilson, to whom all communications should be addressed.

The Irish Question.—We have recently had brought before us a case in which an electrical engineer in Ireland was "turned down" for an electrical contracting installation job because he was a Roman Catholic. This reminds us of other cases, which will also be within our readers' memory, of Irish Councils which have advertised for a borough electrical engineer whose primary qualifications were to be a knowledge of Irish history and membership of the Roman Catholic persuasion. Electrical qualifications, apparently, are of secondary importance for electrical work in some parts of Ireland. What deplorable bigotry! As electrical engineers, it moves us to ridicule and to scorn, but, as Englishmen eager to see the Irish Question settled once and for all it fills us with despair.

Institution and Lecture Notes.—Institution of Civil Engineers.—On Wednesday, the 25th "James Forrest Lecture" was delivered by Sir John Wolfe Barry, chairman of the Engineering Standards Committee, the subject being "The Standardisation of Engineering Materials, and its Influence on the Prosperity of the Country." The author, after a feeling reference to the loss sustained by the Institution in the recent death of the founder of the series of discourses, outlined the history of the Committee and its work, since it was established at his suggestion in 1901; as showing the need for standardisation, he cited the case of tramway rails, of which there were at that period no fewer than 70 different sections in use, now replaced with advantage by five standard shapes. The original Committee, consisting of only seven members, has grown to the present far-reaching organisation with a main Committee of 22 members, 64 Sectional Committees and Sub-Committees, and numerous Panels, dealing with standards relating to, practically speaking, the whole of engineering practice. There are now well over 500 members of the various Committees, giving their time and experience to this work of ever-growing national importance. The number of Specifications issued to date is 77, and others are under consideration. The total expenditure of the Committee has been about £51,000, or about £3,400 per annum, towards which the Government has contributed £10,397, the Indian Government £1,800, and the engineering profession and industry—in addition to time and money devoted gratuitously by members of the Committee to the work—£20,000. From 85 to 95 per cent. of our output of steel sections, and 75 per cent. of tramway rails, are rolled to British Standard, and the proportion of bullhead railway rails rolled to standard is rapidly approaching 90 per cent. Most of the telegraph material employed by the British Post Office, the whole of the tramway poles, and at least 90 per cent. of the cables and wires for electric light, telegraph, and power purposes, are made to British Standard. Great economies in manufacture have resulted from the adoption of standard designs.

Lastly, Sir John referred to the steps which had recently been taken to assist manufacturers in competing successfully in foreign markets by the translation of the Specifications into French, Spanish, and Russian, with metrical equivalents for the British measurements and formulæ, the formation of Local Committees at 12 important trading centres, and the reduction of the price of the Committee's publications to about 1s. per copy, and stated that cordial support had been promised by the Government towards the fulfilment of these proposals. The trades concerned had subscribed close upon £13,000, the Government had made a grant of £10,000 towards the expenses of the new departure, and the work had been commenced.

Iron and Steel Institute.—The annual report of the Council for the year 1916 shows that the total membership on December 31st was 1,872; 86 members of alien nationality were struck off the roll, in accordance with a new by-law confirmed at the last annual meeting. The accounts show total receipts £4,767 and expenditure £4,208, leaving a surplus of £559. Five Technical Committees were appointed to deal with subjects of practical interest to the iron and steel industries. A new class of members, to be known as Associates, has been formed. A system of co-operation with kindred Institutes has been inaugurated, and the question of securing joint accommodation has been taken up with the Institutions of Mining and Metallurgy and Mining Engineers and the Institute of Metals. Steps have been taken towards promoting the study of science in schools. A list is given in the report of members on active service.

Institution of Electrical Engineers.—The annual general meeting of the YORKSHIRE LOCAL SECTION was held on April 25th, at Leeds. The accounts were received and approved, and the chairman announced that the only nomination for the chair was Mr. W. Lang, who therefore took the office; the vice-chairmen elected were Mr. R. H. Campion and Mr. E. C. Wallis; Mr. J. D. Bailie was unanimously re-elected hon. secretary. The filling-up of four vacancies on the Committee was balloted for, resulting in the election of Messrs. W. M. Rogerson, W. B. Woodhouse, J. Shepherd, and C. A. Hefford. At the conclusion of the business, Mr. C. Vernier read his paper on "Wayleaves," and a discussion took place thereon.

The ballot papers issued last week-end for the election of the Council contain the following names:—President, C. H. Wordingham; vice-presidents (two vacancies), G. W. Partridge, Dr. A. Russell, W. B. Woodhouse; hon. treasurer, J. E. Kingsbury; ordinary members of Council (six vacancies), Ll. B. Atkinson, W. A. Chamen, J. S. Highfield, T. Roles, Lieut.-Colonel A. E. Le Rossignol, C.B., Sir W. Slingo, Lieut.-Colonel H. C. Sparks, D.S.O., M.C., A. P. Trotter, B. Welbourn. Like that of Mr. G. W. Partridge, the nomination of Mr. T. Roles, electrical engineer to the Bradford City Council, emanated from without the I.E.E. Council.

The Council has issued a memorandum, pointing out that the articles of association do not contain any provision for proxy voting, and explaining the procedure. It is proposed to adopt this practice, and a special general meeting has been called for the purpose of passing the necessary resolutions, to take place on May 17th at the Institution of Civil Engineers, at 7 p.m., following the annual general meeting, which commences at 6 p.m.

Royal Institution.—The annual meeting was held on Tuesday last, when the report of the Committee of Visitors for the year 1916, testifying to the continued prosperity and efficient management of the Institution, was read and adopted. Twenty-three new members were elected in 1916. The following gentlemen were unanimously elected as principal officers for the ensuing year:—President, the Duke of Northumberland; treasurer, Sir James Crichton-Browne; secretary, Colonel Edmond H. Hills.

On May 15th a special course of evening lectures on "Some Industrial Applications of Electricity" will be commenced at the Municipal Technical Institute, West Ham. A notice respecting the ground to be covered by the course appears in our advertisement pages to-day.

Wiring with Tough Rubber Compound Cables.—The following letter arrived too late for inclusion in our "Correspondence" columns:—

"I have read with much interest the article by Mr. W. Ellerd-Styles, A.M.I.E.E., on the above subject which appeared in your issue of April 27th, as I also have used 'C.T.S.' in my business as a contractor, and appreciate many of its merits. Most of the fire insurance companies, however, appear to adopt the 'sitting-on-the-stile' attitude towards its use in private houses and similar situations, waiting for experience to be gained in time from results (from the fire insurance standpoint), and leaving all responsibility on the shoulders of the contractor who ventures to recommend the 'new system' to the customer.

"They generally recommend, when asked, 'screwed conduit,' and, rightly or wrongly, seem to fear trouble in the event of a fire of its being extended with C.T.S., owing to the latter's sheathing not being fireproof. I have personally found that customers are very loath to accept a C.T.S. installation, which does not seem to have the whole-hearted backing of the fire insurance companies, in spite of their general acceptance of the I.E.E. rules.

"Where C.T.S. is run down the walls, flush in plaster, to switches, &c., I suggest that the best plan is to enclose it in short lengths of light gauge steel conduit of ample size, which would act as a wire-way only, to enable the wires to be withdrawn or added to later (as, for instance, where an extra switch is required to control an existing electrolier), without disturbance to walls or decorations. Where C.T.S. wires are run below floor boards, I have found the best procedure is to thread them through holes, drilled in the joists, sufficiently low down to avoid risk from nails.

"If the use of C.T.S. is to become general for house and similar lighting installations after the war, it is essential, I agree, that the manufacturers very considerably reduce their prices; and further, the fibre-covered junction box, which they supply for use in dry situations, should, in my view, be replaced by one of a more substantial and better design, preferably fireproof, and with terminals that will not be liable to loosen through vibration or when used with alternating current.

"I suggest that a suitable four-way junction box, for fixing under floors or on the surface, of moderate cost, is material to the avoidance of waste of wire with the 'loop-in' system, and, to ensure a good mechanical job, the sheathing should be gripped in position when the cover is on, to prevent any strain on the wires where fixed under the terminal screws.

"The manufacturers do not seem to be keen on recommending C.T.S. (without special treatment) for use out of doors, where exposed to the sun's influence, and I have heard that under such conditions the sheathing has been found to crack open in a very short time.

"Some further information as to the use and limitations of C.T.S. in other situations, say, for power work in factories, underground work, and in connection with motor wiring, would be useful. I presume the I.E.E. rules permit of C.T.S. cables being 'grouped' with pressures up to 'medium.' (Home Office definition.)

"If Mr. Styles would further favour us with the benefit of his experience in connection with the above, and similar practical details, he would add much to our indebtedness.

"This lengthy reference to methods of switching and details of circuits, of course, applies equally to conduit systems, and does not appear to be peculiar to the adoption of C.T.S.

"ANOTHER MEMBER OF THE E.C.A."

Navy Employment Agency.—This admirable institution devotes its attention to finding employment for men of the Royal Navy and Marines on their leaving the Service, only men of the highest integrity being enrolled on its books; amongst the numerous trades concerned are those of stoker, engineer, electrician, and mechanic. Application for men should be made to the Secretary, 25, Victoria Street, S.W. 1.

Manslaughter of Woman Tramcar Conductor: Sentence.—Alfred E. Ryman, engineer, Greenwich, charged with the manslaughter of Elizabeth Mitchell, tramcar conductor, by pushing her off the car, was at Lambeth last week sentenced to six months' hard labour, the case being dealt with as one of aggravated assault.—*Daily Mail.*

Medal for a Female Conductor.—A medal is to be presented to a woman tramcar conductor, of Blackheath, Staffordshire, who by promptly applying the brake on a runaway car averted a serious accident. She is the wife of a wounded soldier.—*Times.*

Puncture Voltage Indicator.—In testing cables, &c., to breakdown, the occurrence of a puncture naturally causes the voltage to drop, and destroys the reading of the maximum voltage. To avoid this drawback, Dr. Clayton H. Sharp, director of the Electrical Testing Laboratories, New York, has patented the use of a Fleming valve in series with an electrostatic voltmeter, connected in shunt to the testing voltage. As the capacity of the electrostatic voltmeter may of itself be insufficient, it is desirable to connect a condenser across its terminals. The instrument being then charged unidirectionally, will indicate the maximum voltage of the wave continuously, but when puncture occurs with the accompanying drop of pressure, the voltmeter reading will remain near the highest point attained, the rate at which it falls depending upon the rate of leakage of the charge and the capacity of the condenser.—*Electrical World.*

America at War.—Believing that electricity will play a very important part in the preparations for, and conduct of, the war, President H. A. Wagner, of the National Electric Light Association, has officially tendered the services of that Association to the Government.

Mr. Paul M. Lincoln, commercial engineer of the Westinghouse Electric and Manufacturing Co., East Pittsburgh, Pa., has been appointed a captain of the Engineers Corps in the United States Army. This announcement comes with that of the appointment of a number of prominent engineers in the country to positions in the Army, all made by President Wilson in his appreciation of the importance of securing the ability and training of the country for use in national defence measures. Mr. Lincoln has for 24 years been associated with the Westinghouse Co. He is a past president of the American Institute of Electrical Engineers.—*American Electrical Review.*

Decimal Coinage and the Metric System. — The following extract is significant of S. African opinion: Many times in these columns has been urged the need for the introduction of a decimal coinage and of the metric system of weights and measures. Perhaps that is the reason why the lately-formed Manchester and District Decimal Association—an influential body of manufacturers and other business men—has addressed us on the matter. . . . We reprint elsewhere the case as made out by the Association for a decimal coinage, and next week we hope to print the longer case for the adoption of a metric system of weights and measures. There is nothing we can add to the presentation of both cases, unless it is to say that nowhere is it more clearly recognised than in this country that if the British manufacturer is to hold his own after the war he must begin now to prepare by reforming his systems of currency and weights and measures. That is the reply of South Africa to the progressive people who are at the back of the Manchester and District Decimal Association. No more useful work could be done for the future of British overseas trade than the successful fruition of the task they have set themselves.—*South African Mining Journal.*

Lord Balfour's Committee on After-War Trade has been strengthened by the addition of Sir William Pearce, Sir Charles Henry, Sir Archibald Williamson, and Sir William Priestley. The Committee is now investigating the question of the possible substitution of the metric and decimal systems for our existing coinage, weights, and measures. It has already heard a great deal of evidence on the working of the metric and decimal systems in various countries, but hasnot yet come to a decision.—*The Times.*

Appointments Vacant. — Working foreman, for the Curragh Camp power station; senior charge engineer, for the North Metropolitan Electric Power Supply Co.; assistant electrical engineer (£360), for the Government Electrical Department, Federated Malay States; switchboard attendants, teacher to train disabled soldiers (£4), for the West of England Joint Executive Committee, Bristol; two switchboard attendants (37s. 6d.), for the borough of Burnley electric lighting department; overhead lineman, for the Burnley borough tramway department; power-house staff, for the Military Camps in the Western Command; overhead lineman (45s.), for the Walthamstow U.D.C. Tramway Dept.; charge engineer (£130), for the Llandilo U.D.C. See our advertisement pages to-day.

Inquiries.—A correspondent urgently requires flash-lamp bulbs, 2½ or 3½ volts, with flattened tops, V-shaped filaments, half opal glass, and miniature Edison screw caps; makers of the Hopkins speed indicator are asked for; also makers of "Mirror" electric lamps, and round tins of 3 to 12 lb. capacity.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station and Tramway Officials.—Mr. G. W. Humphreys, chief engineer of the L.C.C., has accepted a commission in the Engineer and Railway Staff Corps, R.E. (T.F.).

The Highways Committee of the L.C.C. has granted extra duty pay to the following officers for special services rendered during 1914, 1915, and 1916:—Mr. T. L. Horn (resident electrical superintendent) and Mr. J. Terry (district traffic superintendent), £25 each; Mr. H. S. May (assistant rolling stock superintendent), £50; Mr. F. H. Wigner (second-class assistant), £20; Mr. H. R. Docker (second-class assistant), £35.

General.—Mr. W. Haydon has resigned his membership of the L.C.C. Highways Committee. The Committee recommends the appointment of Mr. W. C. Bersey in his place.

The Highways Committee of the L.C.C. has re-appointed the following special sub-committees in connection with the tramways department:—Tramways Organisation: Mr. G. M. Gillett, Mr. H. H. Gordon, Mr. F. C. Harrison, Mr. Jas. Little, and Mr. W. J. Squires. Tramways Operation: Mr. H. H. Gordon, Mr. F. C. Harrison, Mr. W. J. Squires, and Mr. H. Ward, together with the *ex officio* members in each case.

At Werneth, Oldham, on April 16th, the marriage took place of Lieutenant Bertram Hoyle, R.N.V.R., A.M.I.E.E., and Miss Florence E. Dowd, of Oldham.

Mr. Thomas Pratt, head of the firm of Chr. Pratt & Sons, Ltd., electrical furnishers, Bradford, who is vice-president and chairman of executive of the National Chamber of Trade, and Mrs. Pratt, have had the unique good fortune to have their eight sons—seven soldiers and the other in charge of an aircraft department—and their daughter, a trained nurse, all home together.

Mr. R. B. Pilcher, Secretary of the Institute of Chemistry, has been presented with a silver rose bowl on the completion of 25 years' service.

Dr. J. F. Crowley, who has for some time had charge of the textile department of Messrs. Siemens Bros. Dynamo Works, has been appointed to represent Ireland on the Board of Trade Committee on Electric Supply. He is a native of Co. Cork.

Roll of Honour.—Leonard Strugnell, who joined up in October, 1914, when he had just completed his apprenticeship with Messrs. Laing, Wharton, Ltd., has been awarded the Military Medal for bravery at the Front, and has been recommended fc. a Commission.

Second-Lieutenant Fred W. Corner, a former station engineer at the works of the Oxford Electric Co., Ltd., has fallen in action in France whilst with the Australian Light Infantry.

Private Hugh Devlin, who was formerly engaged at Siemens Bros.' Works, at Stafford, has died of wounds received in action.

Private W. Fishwick, North Staffs. Regiment, who was before the war with Messrs. Bullers, Ltd., electrical china manufacturers, of Hanley, has gained the Military Medal for gallantry.

Sec.-Lieut. V. A. Hunt, South African Infantry, killed on April 9th, aged 25, was a member of the South African Civil Service, Department of Posts and Telegraphs.

Major Howard C. Symmes, South African Infantry, who was killed on April 9th, aged 43, was, according to the *Times*, Inspector of Machinery and Electricity for the Orange River Colony Government, Mines Department, and J.P., B.A. McGill University, Fellow of the South African Institute of Engineers, and Assoc. Inst. of Mech. and Elect. Engineers (Eng.). He fought through the German South-West African campaign, on the conclusion of which he came to England with the South African Infantry.

Sergeant-Major A. W. Tinsley, an employé at Manchester Corporation electricity department, has been awarded the Medaille Militaire.

Private H. Hampson, killed in action, was employed at the Liverpool Corporation electric power station, Lister Drive.

Rifleman W. Wilkinson, Rifle Brigade, killed in action, was employed at the British Westinghouse Works, Trafford Park.

Private John W. Sugden, killed in action, was employed at Messrs. Ferranti's Works, Hollinwood.

Private W. Whitehead, Lancashire Fusiliers, reported killed in action, was employed at the Lancashire Electric Power Co.'s station at Radcliffe, Lancs.

Bombardier J. Woodford, R.G.A., who was injured whilst engaged in moving guns, and is in hospital at the base in France, was employed at the L. & Y. electric trains depôt, Southport.

Gunner Ewart Doodson (19), who has been killed whilst making an adjustment connected with a "Tank," was an employé at the Yorkshire Electric Power Co.'s station at Thornhill.

Corporal W. E. Bass, R.F.A., who was severely wounded on Good Friday, and died the following day, was with Mr. E. Arthur Pinto, A.M.I.E.E., of Hythe and Ramsgate, and enlisted early in the war. He was twice promoted for gallantry in the field, and won both the Military Medal and Bar, and had been previously wounded.

Miss Ivy Thorncroft, who was killed in last week's bombardment of Ramsgate, was employed at Mr. Pinto's Margate branch.

Obituary.—Mr. Rankin Kennedy.—The death of Mr. Rankin Kennedy, which we briefly announced in our last issue, occurred somewhat unexpectedly in his sleep from heart failure, after he had been in failing health for some time, though not confined to bed. He was 63 years of age. He served his apprenticeship in the engineering works of Messrs. Andrew Barclay & Sons, Ltd., Kilmarnock. He gained a Queen's Scholarship, and studied science and physics at South Kensington Science School, London. In 1880 he designed and constructed the first practical dynamo-electric machine in Scotland, which was installed in Clarke's Thread Mills, Paisley. In the following year he became chief engineer to the Railway & Electric Appliances Co., and in that capacity invented certain dynamos and motors. He also published the discovery of self-regulating electrical transformers, but, on the advice of Lord Kelvin, he did not patent it, Lord Kelvin holding that it was not subject matter for a patent. It is believed that had he done so it would have become a valuable master patent. In these early days, Mr. Kennedy

carried out many pioneer electric light and power installations in sawmills, ships, mines, factories, and engineering works. In 1888, to the order of Lord Kelvin, he designed the dynamo for the electrical laboratory at Glasgow University. He installed the first electric light in the old Glasgow Corporation Picture Galleries. The wiring was run on the three-wire system, and Mr. Kennedy claimed that this was the first use of that system, and that it anticipated Hopkinson's and Zipernowsky's patents. He paid two visits to the States—once expressly for the purpose of inspecting the Westinghouse works, and on the other occasion he went as Electrical Review special commissioner to the Chicago Exhibition. He contributed many articles to the technical Press, especially the Electrical Review, and raised many interesting discussions. He also wrote many books, including "Electrical Installations" (five volumes), "Modern Engines and Power Generators" (six volumes), and others on electrical distribution, marine propellers, aeroplane construction, &c. In conjunction with his consulting work, and assisted by one of his sons, he devoted himself assiduously to experimental and research work extending over a wide field, including electric meters, petrol motors, exhaust ejector-condenser silencers, ignition magnetos, and air-cooled petrol motors. For the past ten years he had not undertaken consulting work, but devoted all his time to experimental work on marine hydraulic jet propellers and flying machines. He believed that ultimately the present design of aeroplane would be abandoned for the "helicopter" type. He carried out many experiments on this type of machine. He had been engaged recently perfecting an automatic electric indicating log for ships, also a compass for aeroplanes, and a compass for submarines. On the last of these he was engaged at the time of his death. Mr. Kennedy leaves two sons, to whom we desire to express our deepest sympathy in their loss.

Mr. V. M. Dunsford.—The *Daily Mail* records the death, on May 1st, of Mr. V. M. Dunsford, Deputy Controller of the Central Telegraph Office, London. Mr. Dunsford began life as a telegraphist in 1881.

Wills.—Mr. Ernest Ruffer, chairman of the Spanish Telephone Co., Ltd., left £256,853 net.

The late Mr. James Forrest left £13,574 net personalty. According to the *Times* he left to the Institution of Civil Engineers a number of testimonials presented to him by past presidents and others, and he asked the Council of the Institution to have the articles exhibited every year on the occasion of the James Forrest Lecture. He also left £500 to the Institution, to be added to the "James Forrest Lecture Trust Fund."

NEW COMPANIES REGISTERED.

Modern Electric Welding Co., Ltd. (9,840).—Private company. Registered in Edinburgh, April 19th. Capital, £5,000 in £1 shares. To carry on the business of welders of iron, steel, and other metals, &c. The subscribers (each with one share) are: Wm. Slack, 119, Albert Road, Langside, Glasgow, engineer; John Maxwell, 113, St. Vincent Street, Glasgow, solicitor. The first directors are: W. Slack, W. Stewart, H. Slack, and J. Maxwell. Solicitor: J. Maxwell, 113, St. Vincent Street, Glasgow.

Russian Industries, Ltd. (147,167).—Private company. Registered April 17th. Capital, £30,000 in 28,500 ord. shares of £1 each and 30,000 management shares of 1s. each. To carry on the business of engineers, contractors, concessionaires, financial agents, merchants, shippers, explorers, miners, financiers, &c., in relation to Russia and the British Empire. The subscribers (each with one share) are: H. W. Thornton, general manager, Great Eastern Railway; A. D. Rutherford, 40, Queen Victoria Street, E.C., retired bank manager; L. Oury, 3, Thames House, Queen Street Place, E.C., director and manager, Mozambique Co. The first directors are not named. Solicitors: W. R. Russell, 3, Lombard Street, E.C.

R. Armstrong & Co. Ltd. (147,182).—Private company. Registered April 18th. Capital, £5,000 in £1 shares. To carry on the business of merchants, importers, exporters, contractors, brokers, and suppliers of materials in connection with the manufacture of cable and wire, electrical, telegraph, telephone, engineering, rubber, and rubber goods, &c. The subscribers (each with one share) are: H. C. Rose, 123-5, Cannon Street, E.C. 4, merchant; H. D. Douglas, St. Moritz, Ogmont Road, Sutton, Surrey, electrician. The first directors are: H. C. Rose (chairman) and H. D. Douglas. Registered office: 3, Cloak Lane, E.C.

Railway Phonopores, Ltd. (147,251).—Private company. Registered April 24th. Capital £5,000 in £1 shares. To carry on the business of electrical and mechanical engineers and merchants, manufacturers of phonopore and other induction coils, &c. The subscribers (each with one share) are: C. Isaac, Brockley House, Slough, Bucks., engineer; Irene M. Randall, 82, Huxley Road, Leyton, E., typist. The first directors are E. W. Smith and C. Isaac Solicitors: Frank Simmonds & Carters, Broad Street House, E.C.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Underground Electric Railways Co. of London, Ltd.—Trust deed dated April 3rd, 1917, to secure £700,000 5 per cent. three-year secured notes, charged on £681,000 London Electric Railway 4 per cent. debenture stock, £412,000 4 per cent. perpetual debenture stock of the City and South London Railway Co., and £120,000 London Electric Railway 4 per cent. pref. stock. Trustees for note holders: Union of London & Smiths Bank.

W. A. & R. J. Jacobs, Ltd.—Issue on April 4th, 1917, of £700 debentures, part of a series of which particulars have already been filed.

CITY NOTES.

Brush Electrical Engineering Co., Ltd.

The report for 1916 states that large contracts are in hand, the current order list being well above the average. The profit and loss account shows that after providing for general charges, maintenance of plant and buildings, and interest on the company's debenture stocks and loans, there remains a balance of £21,635, and, with the amount of £9,321 carried forward from the previous year, a total available balance of £30,956. The directors recommend that £8,000 be applied for depreciation of property, patents, and goodwill, that £2,044 be applied in payment of the further 4 per cent. interest to which the holders of the company's 6 per cent. prior lien participating second debenture stock are entitled out of the first net profits available for dividend in any year, that £7,055 be placed to general reserve, and that the balance of £13,857 be carried forward. The reserve account had been increased during the year by £2,979, the profit on purchases of the company's debenture stocks for sinking fund purposes, and by £608, the profit on the sale of land at Cricklewood. The further sum of £7,055, which the directors now recommend be appropriated to this account, will raise the reserve fund to £20,000.—*Financial Times.*

British Westinghouse Electric and Manufacturing Co., Ltd.

Mr. J. Annan Bryce, M.P., presided, on April 26th, at Hamilton House, over the annual meeting. He first dealt with the items in the balance sheet, and said that on the debit side the first item of capital remained unchanged. The item "sundry creditors and credit balances" stood at £621,113, showing an increase of £212,046 over 1915, owing partly to increase in the volume of business and partly to the rise in the prices of materials. The item "reserve for employers' liability" had been increased this year by £10,000, an amount double that appropriated last year. It was considered advisable to make the larger appropriation in view, not only of the larger number of persons employed, but of the present character of the labour. The number of workpeople employed in the factory was at the outbreak of war 5,223, of whom 4,720 were men, and only 513, or about 10 per cent., women. At the end of 1915 the number was 6,679, at the end of 1916, 7,284, and at present the number was 8,037, of whom 5,505 were men, and 2,532, or about 31½ per cent., were women. There had thus, since war began, been an increase of 785 men and 2,019 women, making a total increase of 2,804. The old skilled labour had almost entirely disappeared, and the present *personnel*, the result of continual dilution by less skilled, or entirely unskilled, elements, was necessarily less experienced. As a consequence, accidents had unfortunately increased, though every possible safeguard that could be devised was provided against them, and the number of accidents was nearly a third greater in 1916 than in the preceding year. His remarks on the character of the labour were made in relation to the advisability of increasing the reserve for employers' liability, and in no way involved any complaint of the new labour itself in the abstract. Though it was at the outset entirely unskilled and inexperienced, it was anxious to learn, and did its best. It was gradually becoming experienced and acquiring skill. The women had been most willing even to tackle work requiring physical strength apparently in excess of their powers, and they were becoming proficient in many kinds of difficult work. In addition to the factory hands, there was an office staff of about 2,000, of whom 600 were women. The total number of employés was, therefore, about 10,000, of whom about one-third were women. Special depreciation had been increased by £9,000 to cover additional wear and tear due to the present conditions of operating the machinery, such as the character of the labour, necessity for night shifts, &c. The item "stock and material on hand" showed an increase of £158,537, due partly to the growth of the business, partly to the higher cost of material, and partly to the fact that, from the difficulty of obtaining some particular material at the proper time, work on orders had to be suspended and their completion postponed, often for a long period. The item "completed work on contracts" showed the considerable increase of £60,000, owing largely to delivery being delayed by lack of transport by rail or ship. This difficulty was becoming accentuated every day. By the end of March in the current year, there had been since January 1st a further accumulation of completed goods awaiting dispatch of something like 600 tons, representing roughly £100,000 in value. This difficulty was likely to increase, and was entailing a serious lock-up of funds. The French company had done well, but the Italian company had made some loss, due to the rise in wages and materials since the contracts were taken. These factors affected both countries, but while the French Government recognised and made allowance for them, the Italian Government did not. In France recent legislation had imposed taxation on excess profits, but all the principles upon which it would be applied had not yet been settled in practice, and the extent to which the company would be affected was therefore still uncertain. The Norwegian company had made a small profit. There was reason to believe that after the war there would be a good field for these companies, and

preparations were being made by reorganisation and reconstruction of buildings, in so far as was possible under war conditions, for taking advantage of an increased demand which, at any rate in France, where destruction had been so great, was likely to be large. The gross profit for the year was £311,198, an increase of £17,210. The net profit was £199,346, an increase of £22,595. The relative increase in the net profit as compared with that in the gross profit, viz., £5,385, was mainly due to the smaller amount written off for ordinary depreciation. The tonnage output in 1916 was 22½ per cent. greater, and the value, owing to higher costs, 40 per cent. greater than in 1915, but the aggregate gross profit was in 1916 only 5.8 per cent., and the aggregate net profit only 13 per cent. greater than in 1915. There had thus been a great fall in the rate of profit. There had been great advances in wages and materials which could not be foreseen when the orders were estimated for, and their effect had been accentuated by the unavoidable delays in the completion of orders, prolonging, as these delays did, the period during which the adverse causes were in operation. A further cause of the diminution of rate of profit had been the continual dilution of labour. It would, however, have been possible to increase the dividend if it had not been necessary to carry over a much larger sum than in 1915. With the still uncertain effects of the Munitions Act and Excess Profits taxation it was absolutely necessary to provide a large sum, and the amount of the carry over, £89,735, was none too great, though he hoped it would prove adequate. During the year under review their orders had been more than maintained, as, excluding the large railway contract mentioned last year as taken in 1915, the normal business of 1916 showed a considerable increase both in volume and value, while in the current year there was also a considerable increase in orders as compared with the corresponding period of 1916. There had been a satisfactory addition to their trade with the Continent, particularly in France and Russia, while the business with Australasia and South America had considerably improved. On the whole, their exports, in view of the difficulties of transport, must be considered satisfactory. He had referred to the constantly increasing lock-up of funds, and though at the end of the year the financial position was quite easy, it might be that before long, under present conditions of high wages, dear materials, delays in completion of orders with consequent longer and larger locks up of capital, and a growing business necessitating fresh manufacturing facilities, they might have to contemplate an addition to their capital. So far they had been able to meet the position out of revenue, but it would probably not be possible to defer much longer a request for permission to raise fresh capital. He was not alone in thinking that the policy of the Treasury in increasing the direct taxation of industry had gone far enough, and in one respect a great deal too far. He described fully last year the highly inequitable effect upon them of the Excess Profits Tax, and since then the injustice had been enhanced by the policy of the Treasury in the last Finance Act, in virtue of which it not only exacted an additional 10 per cent.—that was 60 per cent. in all—of the profits, but reserved to itself the right to claim either this 60 per cent. or the 80 per cent., calculated on a different system, exactable from controlled establishments under the Munitions of War Act, whichever might give a better result to itself. It was not, however, so much the injustice on which he had to insist. What he was quarrelling with at the moment was the policy of killing the goose which laid the golden egg, the policy which prevented an industrial concern from providing for expansion out of savings. How was industry going to provide after demobilisation for the employment of the vast additional mass of labour which would be thrown on the market by the return of the troops, and the cessation of munition requirements? Remember, that to meet the colossal taxation to be borne by the present and rising generations, there must be an immense increase in production. Where was the money to finance it to come from? There was much talk of trade banks and of industrial banks. They were excellent things, but even if they were to be provided in unimaginable numbers, who was to provide their funds? Not the income-tax payer, whom the late Secretary of the Treasury menaced with 10s., or the super-tax payer, who already paid 10s., and was threatened with an increase. Not the excess profit taxpayer, who already, in many trades, was being sucked dry so far as the chance of providing for expansion was concerned, and who also was being threatened with a rise to 80 per cent. He could not believe that the present Chancellor of the Exchequer, who was himself a business man, would fail to recognise the disastrous effects of the excessive taxation of industry. So far, other belligerent countries had shown more consideration for industry than this country. Some of them had followed their example in imposing taxes on excess profits, but none of them were anything like so severe as Great Britain. In some cases they were graduated up to a maximum of 50 per cent., while in others, as, for instance, in France, there was the wise provision—and this was the point he wished to emphasise—that profits devoted to expansion were allowed to escape altogether. Germany, their principal trade, as well as war, enemy, had not, so far as he knew, imposed any excess profits tax, and had not even increased the income-tax. As a result, the great German concerns in the electrical trade had accumulated vast sums in cash—it was true it might prove to be only paper cash—for the inevitable fight after the war. He had lately seen the balance sheets of three of these companies for the year 1915, the Allgemeine, the Siemens-Schuckert, and the Bergmann. The first had by that time accumulated a cash reserve of 7½ millions, the second 2½ millions, and the third 1½ millions—sterling, not marks—funds which were expressly mentioned as available for operations after the war ended. It seemed to be assumed by some well-meaning people that when peace was declared there would be an end of economic war also, and they deprecated any measures tending to perpetuate it. They wished them to receive back Germany into the comity of nations—to kiss and be friends, as after a lovers' quarrel. It was forgotten that this war was as much a war for commercial and industrial as for military domination, and that there were no more enthusiastic advocates of it than the heads of the great German industries and financial establishments. It was forgotten that the military war was only the complement of the economic war, which, started half a century ago with the two hundred million indemnity robbed from France, had been waged ever since with the purpose, as they now knew, of dominating the trade of the world. He had before him lately a striking instance. A great German firm had maintained a factory in England entailing for the last ten years an annual loss of some £100,000, with the express object of keeping prices in this country low and so preventing that particular industry from being able to compete abroad. The economic war Germany would renew more savagely and more unscrupulously than ever, if she could, and it must be their aim, if they were not to go under, to use every means to defeat her. As it was, they were urged by the Government to capture her trade, but bereft by it of the wherewithal. The first essential was money. Where was it to come from? Government had been taking the savings of industry, and the manufacturers of this country would have no means to undertake the immense business which the world would offer after the war, while the vast mass of labour set free in this country would be short of employment. There must be a catastrophe unless Government, which had taken the manufacturers' money, stepped in behind him with its credit. Take their own case—they had daily evidence of immense business open to them in every country where they traded, in France, Italy, Russia, Spain, and the Dominions, business demanding great extension of their works and the employment of masses of labour, but which they would be unable to undertake without large additions of capital. Meanwhile others were stepping into the breach. America, with her vast resources, had started a powerful organisation which was already securing business in every quarter. Happily they knew that she had no ulterior objects, and if they could not live alongside friendly competition which was the life of business, they did not deserve to survive. But they could not fight even friendly rivalry without money, and this brought him back to the point with which he started, that not only for their immediate necessities, but for post-war opportunities, if they were to avail themselves of them, they must obtain fresh capital, if they could get it. The Chairman next referred to the excellent progress being made with the company's educational scheme under the able guidance of Mr. Fleming, and also dealt with the number of men who had joined the Forces. Up to the end of February 2,469 had joined, of whom 168 had been killed. In conclusion, he said that while they were faced now and in the future by many and serious problems, they looked hopefully to the future, confident of the loyal support which they had had in the past from their staff and workpeople. Such labour difficulties as they had had it had been found possible to settle by tactful handling, and he was happy to say that in this respect their works manager, Mr. Mensforth, had ably continued the policy of Mr. Lang, now their managing director, who formerly occupied Mr. Mensforth's post. The future of British industry depended upon the loyal co-operation of employer and employed. The interests of the shareholder and of the workman were the same. The one could not be happy without the other. The directors would strive to maintain this identity of interest, and as they had surmounted many difficulties in the past, they looked hopefully to the future.

Mr. Skeel pointed out that the board was doing the same thing as the Government. The company was making money, but it was putting it carefully out of the shareholders' reach. He hoped next year the board would do better for the preference shareholders.

Mr. Birks thought the shareholders were eminently satisfied with the figures. At the same time the question of the return on the preference shares had an important bearing on the raising of new capital.

The Chairman said he entirely sympathised with the remarks made, but so long as they did not know what they had to pay the Government they must have a large carry-over. They could probably easily pay an additional 2½ per cent. on the preferred shares if only they knew what sum they had to pay the Government.

Willans and Robinson, Ltd.

Mr. J. C. Peache, presiding at the annual meeting held on April 24th, at Rugby, said that it was proposed to pay a dividend of 10 per cent. on the small ordinary capital and, after carrying £10,463 to reserve, to pay a bonus of 2s. 6d. per £100 "B" stock and 1s. per share on the ordinary shares. With £10,463 now added to the reserve fund that fund would stand

at £34,812, subject to the payment due to the Government under the Controlled Firms Act. In addition to this there was the special reserve of £7,467 against the "A" and "B" preference dividend accounts. The energies of the company were still directed to special operations, and considerable extensions of plant and to the number of employés had been made. The necessarily increased expenditure had been partly provided for out of revenue and partly by a further advance from the company's bankers. The value of orders on the books was sufficient to ensure full pressure of work for the rest of the year. Included in the orders were some for such items as turbines and Diesel engines, which, being items that formed the chief part of the company's pre-war business, provided a valuable connecting link for the resumption of normal business after the war. It was satisfactory to note that the profit for the year, after allowing for excess profits, was sufficient to maintain the same rate of dividend on the share capital as in the previous year. About 300 of their employés were now serving with the Forces, and 21 had laid down their lives. To these must be added the name of the late Mr. Leslie Robertson, a director, who gave his life for the country at the sinking of H.M.S. *Hampshire*.

Indo-European Telegraph Co., Ltd.

Mr. J. H. Tritton, presiding at the annual meeting, on April 24th, said that owing to general postal delays and staff shortage they were at present unable to submit the report and accounts for the past year. Having regard, however, to the figures that were available, they saw no reason why the final dividend should not be paid on the usual date. The accounts would be circulated at the earliest possible date. They were pleased to be able to pay the final dividend and distribution for the year without encroaching upon reserves, and without diminution of the total amount, and they believed that there would remain sufficient to allow of the provision again out of earnings of an adequate sum of money on account of depreciation. Their holding in British Government securities was large—58 per cent. of the company's capital. The new arrangement with the Eastern Co., which would secure to the Indo-European Co. a sufficient sum after payment of all expenses to provide a dividend of 7 per cent. on the share capital, did not come into force until August, 1916, and the company benefited very considerably by revenue derived from the first seven months of the year. At the last meeting he stated that the directors had decided to enter into a combination of interests with Creed & Co., Ltd. for the development of the wireless patents owned by the Indo and Galletti Companies. That arrangement had fallen through. It became apparent that the interests of Creed & Co., Ltd., were not compatible with this company's interests, and the agreements that had actually been entered into had, by mutual consent, been cancelled. This did not in any way affect the future development of their wireless assets, and he hoped to give fuller information on the extension of the wireless side of the business next year. They had fulfilled important contracts for wireless material. The company's telegraph through service remained interrupted owing to the conflict raging in Europe, but they continued to handle considerable local traffic, which was of great importance just now. They had done their utmost to assist the Russian Government, and believed that their assistance had been of considerable value to them. With the victorious conclusion of the war, and the restoration of their through communication, they would be able to offer to the Government and to the public as efficient a service as in the past. Thirty-seven of the company's English staff were serving with our Armies. Four had laid down their lives. A large proportion of the company's Russian staff were with the Russian Armies.

Johnson and Phillips, Ltd.

Mr. R. W. Blackwell presided at the annual meeting on April 25th. After going through the accounts, he said that the board had considered it advisable, having in view the conditions prevailing at the present time, to carry £10,000 to general reserve, and to place a further £10,000 to special reserve account. They had also thought it best to reduce the book value of their patents by £2,575, inasmuch as they had not been able to fully utilise their patents under existing circumstances, and could not clearly see when normal conditions of trade would be restored. It was the opinion of the board that it would be unwise to make any larger distribution than that recommended (5 per cent., free of tax). In their reserves, and in the carry-forward, it was indispensable that they held a considerable cash reserve. The figures certainly demonstrated that the concern was in a thoroughly sound position. The gross profit for the year under discussion was £13,000 less than that of the preceding year, although the amount at their disposition was only some £3,000 less. The decrease was not a matter which need trouble the shareholders. It was anticipated by the board, and justified the considerable carry-forward provided for at the last meeting. The fact was that their manufacturing and contracting business in times of peace had now been practically wholly shelved, and much of their more elaborate manufacturing plant was necessarily idle. For work of national importance they did not realise any great percentage of profit. Looking at the business in general, he could only confirm what he said at the last meeting. They had not been advantaged by the war; they had merely held their own. They had had great difficulties to meet, and had met them with fair success. It had been no small matter to adapt their plant to meet the special calls that had been made upon them. They had had to lay down much new plant and, to a great extent, they had run it to death. They had lost many of their experienced hands, and had had to bring in substitutes and to considerably employ female labour. Their costs had been greatly increased thereby, for, as they would readily appreciate, the wear and tear upon machinery, and the waste in manufacturing processes when teaching new hands, had been most substantial items of expense. Material had been difficult to obtain, and, in consequence, they had had to buy well ahead and carry much larger stocks than could possibly be required in normal times. To sum up, under existing conditions they had no reason to complain. To the best of their ability they had accepted their share of the national responsibility, and he did not doubt but that the shareholders would be quite content to accept a not excessive return from the year's working of their property.

In reply to a shareholder, the Chairman said he was not a prophet, and therefore could not say exactly how they would stand when the war was over. However, he had not the slightest doubt that the position of the company would be certainly no worse than it was at the present moment, and he had every reason to suppose that it would resume the rate of improvement which it had shown during the few years prior to the war. The reserves that had been made, both last year and the year before, had been made with a view of meeting any possible contingencies that might arise out of the war.

Chiswick Electricity Supply Corpn.—The report for 1916 states that the profits earned, after writing off £933, and paying sinking fund premium and trustees' fees, were £7,647. Interest on first mortgage debenture stock amounting to £3,600 has been paid, leaving a balance of £4,047. The directors recommend a dividend on the shares of the corporation of 5 per cent., less tax, and that the balance of £907 be carried to depreciation reserve fund account. The increase in the cost of production continues, consequent on the advance in the price of coal, of fuel oil, of other materials, and of labour. The directors have endeavoured to meet these adverse conditions by making an advance in the price charged for current.

North of Scotland Electric Light & Power Co., Ltd.—Considering the conditions, the results for 1916 are satisfactory. At Montrose the connections decreased from 1,163 kw. to 1,091 kw., owing to the closing of the Manure Co.'s works. At Brechin they increased from 776 kw. to 815 kw. At Inverness they increased from 1,452 kw. to 1,597 kw. Total connections for the three towns, 3,503 kw. Gross profit £7,550, as against £7,038 for 1915. After meeting interest on debentures and loans amounting to £2,781, writing £138 off suspense account, and adding £2,046 brought forward, the net profit is £6,677. A dividend of 3 per cent. is to be paid, placing £2,000 to renewal reserve account and £1,000 to general reserve account, carrying forward £2,177.

Woking Electric Supply Co., Ltd.—At the annual meeting recently, Mr. Ashby said that owing to the extra cost of fuel, the outlay for generation increased by £4,168; it would have been heavier but for the action of Mr. H. W. Bowden, a director. Rates and taxes—extraordinary to relate—had decreased. A shareholder asked the board to consider the new Labour situation that would arise after the war. It would be a serious matter, and workmen would not be satisfied with what they were having to-day. After paying 5 per cent. dividend the workmen should have a certain percentage; there should be a sort of co-partnership in a limited way.

Indian Electric Supply & Traction Co., Ltd.—The accounts for 1916 show that the surplus on working at Cawnpore was £20,220, against £15,932 in 1915. The net revenue credit is £20,314. London expenditure was £2,410, debenture interest £3,900. Including £800 brought forward, the balance is £14,803. There has been placed to general reserve £3,000, to depreciation and renewals reserve £3,000, written off debenture issue expenses £1,000; a dividend of 7½ per cent. for the year is recommended, leaving £1,757 to carry forward.

Kaministiquia Power Co.—The directors have declared a quarterly dividend of 1¾ per cent., or at the rate of 7 per cent. per annum, for the quarter to April 30th.

Eastern Extension, &c., Telegraph Co., Ltd.—The directors announce that in consequence of delays arising from the war in obtaining the necessary returns from foreign stations and administrations, it will be impossible to present the accounts and balance sheet duly audited in respect of the year to December 31st, 1916, during May, when it has been usual to hold the annual general meeting. Having, however, satisfied themselves that the net earnings of the year will be sufficient for the purpose, the directors have decided to make an additional payment to the shareholders, free of income-tax, of 7s. per share (equal to a dividend of 1¼ per cent., and a bonus of 2 per cent.), making the distribution for the year 1916 8 per cent., free of income-tax.

Eastern Telegraph Co., Ltd.—The directors announce that, in consequence of delays arising from the war in obtaining the necessary returns from foreign stations and administrations, it will be impossible to present the accounts and balance sheet duly audited in respect of the year to December 31st, 1916, during May, when it has been usual to hold the annual general meeting. The directors, however, having satisfied themselves that the net earnings of the year will be sufficient for the purpose, have decided to make an additional payment on the ordinary stock equal to a dividend of 1½ per cent. and a bonus of 2 per cent., making the distribution for the year 1916 8 per cent., free of income-tax, the same rate as was paid for the previous year. The usual distribution at the rate of 3½ per cent. per annum, less income-tax, on the preference stock for the first quarter of 1917 will also be paid.

Oriental Telephone & Electric Co., Ltd.—Owing to the delay in arrival of the mails from the East, it was impossible to complete and issue the annual report and accounts for 1916 by the end of April, as usual. These are now in course of completion, and the annual general meeting of the shareholders will be held about the middle of May.

Ramsgate & District Electric Supply Co., Ltd.—Including £1,146 brought forward, the gross profit for 1916 is £3,878. After allowing for interest at 5 per cent. per annum on outstanding accounts due to contractors, the balance is £2,660. A dividend of 4 per cent. is recommended, placing £1,000 to reserve, leaving £860 to be carried forward.

Calcutta Electric Supply Corporation, Ltd.—The number of units sold during the four weeks ended February 23rd, 1917, amounted to 1,763,149, compared with 1,362,833 units in 1916.

West India & Panama Telegraph Co., Ltd.—Dividends for the last half of 1916: 6s. per share on the first and second preference shares, and 6d. per share on the ordinary (free of tax).

STOCKS AND SHARES.

TUESDAY EVENING.

WRITING on the eve of the introduction of the Budget, it is difficult to steer clear of comment which the Chancellor's speech may render nugatory, if not ridiculous, before the end of the week. The Stock Exchange is closed to-day (May Day), and members are looking forward to a Budget that will introduce heavy taxation in various directions.

Prices are comparatively little affected. Buyers are certainly holding aloof, pending the speech on Wednesday night; and a slight weakening in the War Loan, Consols, and similar stocks is an omen of what the House looks for. It is a platitude to point out that increased taxation spells a lowering of investment prices and a corresponding improvement amongst speculative issues, although the present occasion may prove an exception, so far as the former are concerned, inasmuch as there is so much money available for investment that the floating supply of stock is inadequate to meet it, and we see no reason why this state of affairs should change after the introduction of the Budget.

One of the London electric lighting companies has recently made a new issue of capital in the shape of short-dated debenture bonds; and there is an aggrieved feeling in certain circles that the bonds should have been offered in a provincial city instead of the issue coming to London. It may be inferred from this that the terms are tempting, and probably would have attracted all the money that the company requires had the issue been made in London.

Of course, it was necessary to obtain the sanction of the Treasury to fresh money being raised; and we understand that the ground-floor price was 90 for 4½ per cent. bonds, redeemable in 14 years, drawings to commence very shortly at par. The complaint is that, being a London company, the natural course would have been for the issue to be offered in London in the first place.

The Home Railway market is dull and inert, and the reasons advanced are the proximity of the Budget, together with the increased destruction notified last week by submarines, and the persistent official warnings with regard to the food problems. The last two reasons have a direct bearing, of course, upon domestic stocks and shares; and the Underground division is dull with the rest. Districts drooped to 16, but Underground Income bonds keep reasonably steady at 81, the firmness being helped by the recent announcement with regard to the possibility of substituting coke fuel for petrol. The National Steam Car Co. has just made a new issue of shares, partly with the object of providing for this new departure, the development of which will be watched with great interest.

Electric Lighting shares are uniformly good. For the ordinary there are buyers in nearly every case; and holders decline to sell, notwithstanding the advances which have been made in quotations. The market is still a limited one, so that at one time it is difficult to sell, while at another time it is no easier to buy. But for the present, at all events, there is a strong demand, with very few shares to meet it. Charing Cross, Metropolitans, City ordinary and preference, and County preference show rises ranging from 1s. 3d. to 5s.

Mexicans are the star market in the Stock Exchange. The telegram in the *Times* on Monday, quoting the *New York Times*, to the effect that it would not be more than a few days before Mexico threw in its lot with the Allies, had a remarkable effect upon prices. Rises of 2-5 points were common in the bonds of the utility and railway companies. Mexican Electric Light Fives rose 3 to 31. Pachuca Fives at 26 were 2 points up. Monterey first mortgage debenture at 17½ gained 5. Mexico Tramways first bonds are 7 points up on the week.

Not much stock has been tempted out by these violent advances; and there is a disposition to await events before believing entirely that Mexico has joined the Allies against the Central Powers of Europe. However, it is now possible to realise bonds which have been practically unsaleable for months past. Brazil Tractions, too, have recovered 3½ points after their drop of 6 last week; the preferred at 84½ are also better. Anglo-Argentine Tramways 5 per cent. debenture continues to improve, and other foreigners are generally firm.

The telegraph market has no such long string of rises to its credit as was the case last week, but the previous improvements are being well held; and Indo-Europeans are 25s. better, allowing for the dividend deduction. The reports of the various companies are almost uniformly good, and the payment of dividends free of tax by several of the leading companies again brings their stocks into prominence by reason of the new Budget.

The manufacturing group is quiet. Brush issues are unchanged on the issue of the report, which is regarded as good; the ordinary stock is quoted about 25, and the three debentures at 80, 60, and 52, in the order of their precedence. Rubber shares gave way sharply on consideration of Budget possibilities, which brought in profit-takers. The armament group is hard, but business in most markets has been held in check by the uncertainties surrounding the coming speech of the Chancellor of the Exchequer, the details of which will have been digested before these notes are.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend 1915.	Dividend 1916.	Price April 30, 1917.	Rise or fall this week.	Yield p.c.
HOME ELECTRICITY COMPANIES.					
Brompton Ordinary	10	9	6½	—	£6 18 6
Charing Cross Ordinary ..	5	5	8½	+ 1/16	7 2 10
do. do. do. 4½ Pref..	4½	4½	8½	—	6 18 6
Chelsea	4	3	2⅞	—	5 4 4
City of London	8	8	11⅝	+ ⅛	6 17 8
do. do. 6 per cent. Pref.	6	6	10	+ ¼	6 0 0
County of London	7	7	10½	—	6 16 6
do. 6 per cent. Pref.	6	6	10	+ ¼	6 0 0
Kensington Ordinary	7	10	5½	—	5 11 7
London Electric	3	3	1	—	Nil
do. do. 6 per cent. Pref.	6	4	3⅜	—	5 6 8
Metropolitan	3	3	2⅛	+ 1/16	6 0 0
do. 4½ per cent. Pref.	4½	4½	3½	—	7 4 0
St. James' and Pall Mall ..	3	3	6½	—	6 8 0
South London	5	5	2⅝	—	7 5 6
South Metropolitan Pref. ..	7	7	21/-	—	6 13 4
Westminster Ordinary	7	7	5⅜	—	6 6 9
TELEGRAPHS AND TELEPHONES.					
Anglo-Am. Tel. Pref.	6	6	95	—	6 6 2
do. Def.	33/6	1½	22½	+ ½	6 13 4
Chile Telephone	3	3	7	—	8 14 4
Cuba Sub. Ord.	5	5	8½	—	6 17 8
Eastern Extension	3	3	14	—	*5 14 4
Eastern Tel. Ord.	3	3	141½	—	*5 13 1
Globe Tel. and T. Ord.	7	7	12½	—	*5 14 3
do. Pref. ..	6	6	10	—	6 0 0
Great Northern Tel.	22	22	38	—	5 15 9
Indo-European	13	13	50½ xd	−1½	6 8 9
Marconi	10	10	2⅝	—	3 9 7
New York Tel. 4½	4½	4½	101	—	4 9 0
Oriental Telephone Ord. ..	10	10	2⅛	—	4 14 1
United R. Plate Tel.	3	3	6⅝	—	*6 0 9
West India and Pan.	6d.	6d.	1	—	2 10 0
Western Telegraph	3	3	14	—	*5 14 4
HOME RAILS.					
Central London, Ord. Assented	4	4	60½	—	6 8 0
Metropolitan	1	1	24	—	4 3 4
do. District	Nil	Nil	16	—	Nil
Underground Electric Ordinary	Nil	Nil	1⅞	—	Nil
do. do. "A" ..	Nil	Nil	5/-	—	Nil
do. do. Income	6	5	81	— ½	*6 3 8
FOREIGN TRAMS, &c.	Dividend 1914.	Dividend 1915.			
Adelaide Sup. 6 per cent. Pref.	6	6	5	—	6 0 0
Anglo-Arg. Trams, First Pref.	5½	5½	3½	—	8 16 0
do. 2nd Pref. ..	5½	5½	2⅝	—	—
do. 5 Deb. ..	5	5	68½	+2	7 6 0
Brazil Tractions	4	4	45	+3½	Nil
Bombay Electric Pref.	6	6	10	—	6 0 0
British Columbia Elec. Rly. Pfce.	5	5	61	—	8 4 0
do. do. Preferred	—	Nil	46	—	Nil
do. do. Deferred	—	Nil	39½	—	Nil
do. do. Deb.	4½	4½	64	+ ½	6 12 10
Mexico Trams 5 per cent. Bonds	—	Nil	33½	+7	Nil
do. 6 per cent. Bonds	—	Nil	27	+2	Nil
Mexican Light Common ..	Nil	Nil	19½	—	Nil
do. Pref.	Nil	Nil	17⅛	—	Nil
do. 1st Bonds ..	Nil	Nil	33½	+3½	—
MANUFACTURING COMPANIES.					
Babcock & Wilcox	14	15	2⅝	—	5 4 4
British Aluminium Ord. ..	5	7	27/8	—	7 6 10
British Insulated Ord.	15	17½	19⅜	—	6 17 3
British Westinghouse Pref. ..	7½	7½	2⅝ xd	—	6 9 10
Callenders	15	20	18½	—	7 11 0
do. 5 Pref.	5	5	4	—	6 5 0
Castner-Kellner	20	22	3⅝	—	6 13 0
Edison & Swan, £8 paid ..	Nil	—	1/16	—	Nil
do. do. fully paid ..	Nil	—	1⅛	—	Nil
do. do. 4 per cent. Deb.	4	4	69½	—	5 15 2
Electric Construction	6	7½	1	—	7 10 0
Gen. Elec. Pref.	6	6	9⅜	—	6 3 1
do. Ord.	10	10	14½	—	6 18 0
Henley	20	25	15½	—	8 1 3
do. 4½ Pref.	4½	4½	4	—	5 12 6
India-Rubber	10	10	11⅞	—	*8 8 4
Telegraph Con	20	20	87	—	*6 9 10

* Dividends paid free of income-tax.

PROMOTION IN ELECTRICITY SUPPLY UNDERTAKINGS.

[COMMUNICATED.]

This subject is one of great interest to every employé—manager or apprentice—in an electricity supply department. As viewed from the manager's chair, the question of filling-up vacancies on the staff usually requires much time and thought, and hasty decisions are possible only in cases where it is obvious that a particular employé is the one man specially fitted to fill the vacant post. But this condition is the exception rather than the rule, as it is generally found that the claims of several members of the staff have to be taken into consideration before a final decision is arrived at. What, then, are the qualifications which weigh most in the selection of candidates for vacancies on the staff? Naturally these will differ in detail depending on the nature of the post, but definite rules can almost be laid down which are applicable to all appointments.

In the first place, the appointment should be made on equitable grounds after fair and reasonable consideration. The interests of the undertaking should be paramount, and all questions of kinship, favouritism, prejudice, and influence should be brushed aside. Social connections should have no weight, so far as is humanly possible. Assuming the candidates are honest and trustworthy—and no one is eligible for promotion who is not—the question becomes one of respective capabilities.

General Manager or Chief Engineer.—Much discussion has taken place at Institution and Engineering Society meetings as to the relative importance of commercial and engineering knowledge in the conduct of an electricity undertaking. It is generally agreed that the head of a large electricity supply business should be a commercial man first and an engineer afterwards, and in many cities and towns engineers have had their letter-paper designation altered from "chief electrical engineer" or "borough electrical engineer" to "general manager" or "manager and engineer."

Electricity Committees also are becoming alive to the fact that the smart commercial man with a good knowledge of electricity supply is of more use to an electricity department than the electrical engineer who has a first-class training in turbine or alternator design and construction. In these days when power stations and distribution systems are laid out on stereotyped plans, the operation of an electricity supply department is a matter of routine. But the getting of business and the general policy of the department are problems which require more than mere engineering training. Many undertakings are suffering to-day from the want of initiative and business acumen displayed by their chief engineers, while some of the largest supply systems have been built up by commercial men and by engineers who have developed their business instincts.

The successful head of an electricity undertaking should, therefore, be a good business man, possessing those qualities which usually mark the business man—namely, organisation, common sense, initiative, tact, personality, and a working knowledge of the product he deals in. He must have the knack of being able to choose the men who will be of most use to him. It might be said of the successful manager of an electricity supply department that he could manage a soap factory just as successfully. He will leave his assistants to carry out their allotted duties, and see that they do so. His principal concern will be in regard to the consumers who take the supply. The organisation should be such that, even if the head of the department should be absent from business for a month, the work of the department would be carried on as if he were there. This, however, in no wise implies that his presence is not necessary for the efficient conduct of the business, but rather testifies to the care with which he has organised the undertaking. Although he may not be in actual attendance at his post, his personality is still kept in view by the assistants, who carry on in the usual way.

Chief Assistant.—Regarding the choice of a chief assistant or assistant manager, if the appointment is left to the manager, he will select the man whose qualifications befit him to take entire charge during the absence of the manager. The chief assistant must be absolutely reliable, and in matters of policy, his first consideration should be to follow the course which his superior would have adopted had he been present. The first assistant may be a good engineer, and be able to go into details with the station superintendent or mains engineer, but his greatest asset should be his capability of answering inquiries in the absence of the manager, and his power of exercising control over the other members of the staff. Common sense and tact will go further than mere knowledge of engineering details. The chief assistant must, of course, have the practical and technical training to enable him to be of service to the manager in drawing up schemes for the extension or improvement of the undertaking.

Station Engineer.—The station engineer should be a trained mechanical and electrical engineer, with good practical and theoretical knowledge of boiler, turbine, and electrical operation. If he should have, in addition, some commercial training, he is the man who automatically steps up into the vacant position of chief assistant. While paying particular attention to the boiler house, where enormous sums of money may be wasted, he should at the same time exercise a general supervision over all his staff.

He should encourage his staff to talk over matters in connection with the efficient running of the station, and give consideration to any suggestions which may be advanced with the object of improving the conditions of operation or the reliability of the plant. He is not paid his salary for working with his hands, and it is his fault if there is no one under him who can be entrusted with any particular work. His duties are purely of a supervisory character, and his chief concerns should be the smooth, economical, and reliable operation of all the plant under his charge. Great attention should be given to the question of stand-by plant in cases of failure, and every precaution should be taken beforehand to avoid breakdowns. Many troublesome breakdown repairs have been avoided by systematic inspection and proper maintenance of plant and auxiliaries. A good station engineer will endeavour to so arrange the duties and responsibilities of his staff that he will find some difficulty in knowing how to fill up his own time, and it must be apparent to him that the manager, on visiting the works, would rather see him walking around with a placid air of contentment than discover him running round the works with a worried look in his face. To the manager, the first signifies efficient control, while the latter condition means trouble and anxiety. Breakdowns are, however, often quite unavoidable, but the station engineer should anticipate them as far as possible by insisting on a sufficient reserve of plant being installed to cope with possible untoward events. The less anxiety he gives his superiors the more is he efficiently fulfilling the functions of his position.

Boiler-House Superintendent.—The station engineer's most important assistant is the boiler-house superintendent, whose duties are to see that the boilers and boiler-house auxiliaries are in good working order. The maximum efficiency should be obtained from each pound of coal, and the boiler-house superintendent must, besides being a good engineer, have a knowledge of chemistry. Careful attention should be paid to the calorific values of fuel, grate feeds, and conditions of draught for each boiler unit. The boiler-house superintendent should have an assistant whose sole duties are the testing of coal, the reading and recording of draught gauges, CO_2 recorders, steam or feed meters, Lea recorders, temperatures of feed water, flue gases, superheat, and the tabulation and comparison of results from day to day. It should always be borne in mind that too much attention to these details is impossible, and a capable boiler-house engineer's wages—and those of his assistants—can be saved many times over by a strict and systematic check on all sources of waste heat in the boiler house.

Electrical Superintendent.—The electrical superintendent should have charge of all the electrical equipment of the power station and sub-stations, besides having an interest in the working of the steam plant in the engine room. He should relieve the station engineer of the responsibility of keeping the electrical machinery, switchgear, &c., maintained in thorough order. All electrically-driven auxiliaries

should be inspected daily by his men, and attention called to weak points in any of the various motors driving air, extraction, feed or circulating pumps, stokers, economisers scrapers, or coal and ash conveyors. High-tension switchgear, control gear, relays, rotary converters, transformers, &c., should also be inspected daily by competent men who have the confidence of the electrical superintendent. Like his immediate superior in office—the station engineer—and his confrère (the boiler house superintendent), the electrical superintendent should remember that his particular sphere is the careful supervision of his men to ensure that they perform their allotted duties with precision. As a large amount of their work is of a routine nature, it is essential that its importance should be impressed upon them.

Charge Engineers, Junior Engineers, &c.—The efficient working of the plant—especially during night shifts—is left to the mercies of the charge engineers and their juniors. These members of the staff should, therefore, be selected very carefully. The charge engineer's lot is not usually a happy one, and the remuneration for his services should be on a fairly liberal scale. A good charge engineer is worth his weight in gold, and sufficient notice should be given to his value to the undertaking. From the ranks of charge engineers, capable boiler-house and electrical superintendents are recruited. It should be the object of every engineer-in-charge to qualify himself for promotion to one of these higher-paid posts.

Mains Engineer.—The mains engineer's chances of promotion rest entirely with himself. In many undertakings, the mains engineer is also the chief assistant engineer, and his claims for the supreme position, when vacant, very often have the first consideration. In his dealings with consumers, he has the opportunity of acquiring that business intellect necessary for the successful manager of an electrical undertaking. But he must first of all be a successful mains engineer, and his duties as such are most exacting. He should be conversant with the best methods of laying mains in widely-varying situations. His assistants should keep a record of maximum and minimum currents on the feeders and distributors of the system, and be in close touch with the work of the electrical superintendent in the station. He must be fully alive to the possibilities of development in any section of the distribution system, with the view of being well in advance of increased requirements by any consumer or section of consumers. Additional demands on the feeders and distributors should be anticipated by the mains engineer, and the management should at once be acquainted with particulars of probable extensions to electrical plant in consumers' premises, so that steps may be taken to fulfil the obligations of the undertaking by the provision of extra cables to cope with the additional demands. A record of costs of laying main cables should be kept, so that the work of estimating for cable requirements can be undertaken with simplicity and ease. The mains engineer's assistants should be men whose training and experience have been on lines which render them fitted to take the post of mains engineer when the position becomes vacant.

Consumers' Engineer.—From the commercial point of view the consumers' engineer holds the most consequential position on the staff of the undertaking. He is in immediate touch with the requirements of the undertaking's clients. His duties are to advise consumers regarding the most efficient and economical methods of utilising the electrical energy supplied from the undertaking. He must be fully conversant with the economics of electricity supply, and the best means of driving machinery, lighting workshops, heating and cooking. He must be familiar with every application of electricity for power, lighting, heating, and cooking, and be able to explain lucidly the reasons for charging different rates per unit for different classes of supply.

Knowledge of the electricity supply business is, of course, of the first importance, and an electrical engineering training is also essential; but the duties of the position require sound common sense, tact, and commercial experience, and on these grounds alone the consumers' engineer is the person whose qualifications befit him for the more onerous position of managing the whole electrical undertaking. As consumers' engineer, his staff should consist of a meter superintendent, an installation inspector, a foreman electrician, a public lighting foreman, and a showroom assistant. Subservient to these would be meter testers, meter repairers, meter readers, installation testers, wiremen, motor inspectors, canvassers, and salesmen.

Secretary, Chief Clerk, or Accountant.—The status of the chief clerk of an electricity department has greatly improved with the growth in size and importance of supply undertakings. This position, in the larger town and cities, now carries with it the title of secretary or accountant, and in some cases, where the individual possesses a technical knowledge of electrical engineering, a new position, under the name of commercial assistant, is created.

The duties of the chief clerk are very onerous indeed. The responsibility of the energy accounts rests with him, and all purchases, stores, &c., should come under his jurisdiction. Organisation should be his watchward, and great care must be taken in the appointment of his assistants. He has many opportunities of advancing his position which are denied to the other heads of departments, owing to the frequent consultations which he has with the general manager or chief engineer. His views often carry much weight in matters affecting the policy of the department, and it is possible to conceive that, in the light of present tendencies, the post of secretary to an electricity undertaking may be a stepping stone to the position of manager of the undertaking, just as it may be in other commercial enterprises.

General.—In the promotion of employés in any grade, certain maxims may be laid down which are applicable to almost every case. First consideration is invariably given to the person possessing, besides a fair knowledge of the business required, a large share of sound common sense. Other factors in the question are initiative—not necessarily originality—orderliness, and reliability. A man, however, may be most reliable and painstaking, and yet have very narrowed ideas, which lead him into spending a great deal of time in unnecessary detail. Originality and a mania for special systems often become a nuisance rather than a help. Some originality is necessary, and systems should only be adopted when they tend to simplification of routine work. A great point is the cultivation of a personality, so that your work and instructions carry some weight. Responsibility should be sought, not avoided. Special commendation is always given to the man who can relieve his immediate superior of a part of the latter's responsibility, especially in matters of detail. It is a good plan, therefore, for a superintendent to allow his principal assistant to become familiar with the whole work of the department, not only with the object of sharing his responsibility, but, mainly, to be in a position of recommending his assistant as his successor in office in the event of the superintendent's promotion to a higher post. Many a good superintendent spoils his chances of promotion by keeping information to himself in a selfish desire to improve his indispensability. The folly of his shortsightedness only becomes apparent when his claims to promotion are overlooked for lack of a suitable man to succeed him.

It is a fact that a good workman generally proves a bad master, unless he has cultivated a talent for arranging work and supervising its procedure. The superintendent who works himself cannot, at the same time, exercise a proper supervision over his men.

Promotion by seniority, or on account of long service, should, of course, be adopted where other considerations are equal. But prior claim should always be given to the candidate who has the faculty of being able to use his brains to the best advantage, and who can cope with difficulties which arise. In positions of commercial responsibility and in the supervision of engineering work—whether constructional or maintenance—a tactful manner, a quick understanding, and a good memory, are of great importance.

Spain.—A new company has lately been formed in Barcelona, with a capital of £4,000, and the title La Sociedad de Cobre Electrolitico, to start works for the electrolytic production of weldless copper tubes.

THE DETERIORATION OF CURTIS RATEAU TURBINE BLADING.

A comprehensive paper on the above subject was recently read before the South African Institution of Engineers by Mr. A. Fenwick, who is the turbine specialist to the Rand Power Companies. The paper contains a great amount of valuable information which it is not possible to reproduce *in extenso* in our pages, but the following is a summary:—

The author classifies the various turbines* as follows:—(1) 3,000 kw., 1908-10; (2) 9,600 kw., 1911-12; (3) 4,000 h.p. (compressor turbines), 1911-13; (4) 12,000 kw., 1914-15; (5) 10,000 h.p. (compressor turbines), 1914; (6) 300 h.p. (auxiliary), 1911-13; (7) 550 h.p. (pump), 1912-14. The majority of these operate with a stop valve steam temperature of 320-350 deg. C.

Table I shows the metals in use on the various turbines; some are only in the experimental stage.

TABLE I.—Showing Various Metals in Use for Blading.

Material.	Class of turbine.	Wheel or guide blades.
4 % nickel steel	2 and 3	Guide
Siemens-Martin steel	2, 3, 4 and 5	,,
5 % nickel steel	2, 3, 4 and 5	,,
3 % nickel steel	3	,,
Medium carbon steel	2, 4 and 5	,,
30 % to 32 % nickel steel	1, 2, 3, 4 and 5	,,
25 % nickel steel	3	Wheel and Curtis segment
5 % nickel steel	All classes	Wheel and Curtis stationary segment
Aluminium-bronze	1, 2, 3, 4, 5 & 6	Wheel and Curtis stationary segment
Brass	All classes	Wheel and Curtis stationary segment
Nickel brass	3	Wheel
Monel metal	3	Wheel and Curtis stationary segment

The author includes further tabulated data showing analyses of the steel and non-ferrous alloys in use.

An examination shows a variation of some thousands of running hours in the life of blades of similar material and position in the turbine, and life here represents the running period up to the time reblading was carried out; in some cases the blades could safely have been run for a longer period, and in others blades have run much longer than was dictated by safety.

3,000-*kw. Turbines, Class* 1.—Dealing first with the Curtis stage, and the first three low pressure stages, two materials have been tried, viz., aluminium bronze and 5 per cent. nickel steel, and the superiority of the latter is apparent. Sets 5 and 6, Simmer Pan, were fitted with steel blades, and have been running for six years. In neither case has failure occurred, the running hours up to December 31st, 1916, being 39,119 and 39,298 respectively.

The aluminium bronze blades are quite unsuitable for this part of the turbine. The aluminium content disappears from the surface of the metal, leaving a very brittle layer of copper; where the section of metal is thin, as at the inlet and discharge edge of the blades, it breaks away like glass with

Fig. 1.

light tapping. With continued use, the outer layer cracks and flakes off, exposing the part underneath, which in turn flakes off until the blade is split up into several layers. Where the section of the blade is fairly heavy, as in the Curtis stage, the shape is gradually lost, but the body of the blade remains sound and seldom fails. What usually happens is, the portion which is riveted over to secure the shrouding chips off, allowing the latter to come adrift.

Fig. 1 is a good example of this deterioration, and is from the first row of Curtis moving blades, after being in commission for about 24,000 hours.

Fig. 2 is from the second row of Curtis blades on the same machine; the deterioration is similar, but not so far advanced; the running hours are the same.

The running time before reblading averages for the first four stages on sets 1-4, Simmer Pan, 26,700 hours. The Curtis blades have a shorter life in the later stages, due no doubt to higher temperature in the Curtis casing.

After leaving stage 4 deterioration is in the form of erosion or pitting on the back or convex portion of the blade; the inlet and discharge edges become thin and holed, and easily broken off. Fig. 3 shows typical examples. The blades (from

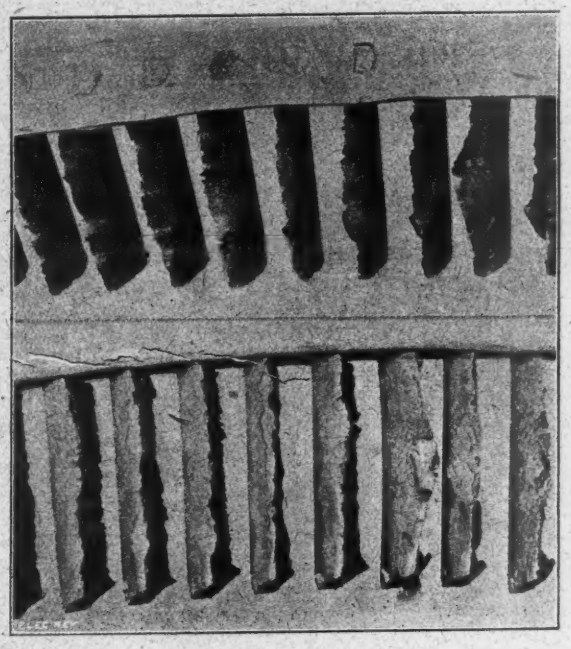


Fig. 2.

stages 5, 6, 7, and 8) ran for 33,665 hours before renewal. The following stages, 9 and 10, also of aluminium bronze, do not suffer. No appreciable improvement in steam consumption resulted from reblading.

The last two stages have running hours varying from 39,000 to 46,500 at Simmer Pan, and up to 52,000 at Brakpan. The present practice is to fit the first four stages with 5 per cent. nickel steel blades, stages 5-8 with brass blades, and the last two stages with aluminium bronze. The author favours nickel steel for the first eight stages and aluminium bronze for the last two.

9,600-*kw. Turbines, Class* 2.—The blading has with two exceptions proved satisfactory on row 3 (Curtis stage); the aluminium bronze proved distinctly unsatisfactory, becoming so brittle in some cases that the blades broke away from the wheel; in all cases the edges were very brittle. The bronze has been replaced with steel with satisfactory results. Fig. 4 shows examples of the above aluminium bronze blades which were renewed after 15,000-18,000 hours.

The aluminium bronze blades in stages 10, 11, 12, proved satisfactory, but in stage 13 breakages occurred, the fracture taking place across the neck of the tee-headed root.

The stress is not excessive (three tons per sq. in), and it it probable that vibration is responsible for the failure.

Some of these stage 13 blades have run from 20,000 to 30,000 hours and are still sound; breakages in three cases occurred after 10,600, 23,800, and 24,900 hours respectively.

4,000-*h.p. Compressor Turbines, Class* 3.—A 25 per cent. nickel steel was used for row 1 on the Curtis stage, and in a particular case failure occurred after running 17,700 hours, due, it is supposed, to brittleness acquired by use with high temperature steam and vibration; 5 per cent. nickel steel used for other sets has given satisfaction.

In the second row of Curtis blades, aluminium bronze and 5 per cent. nickel steel have been employed, the former proving quite unsuitable and being replaced by the latter. In stages 2, 3, and 4 the aluminium bronze has a similar record (specimens are shown in fig. 5), and has been replaced by brass; in stage 5 aluminium bronze stands well, the temperature being low. Aluminium bronze was unsuitable in the stage 6, for mechanical reasons, the blades breaking off at the root after 5,000 to 7,000 hours.

Five per cent. nickel steel fractured in the same manner. A material is required which is not so easily affected by vibration. "Monel" metal is being given a trial. Nickel brass is also being experimented with for stage 5. The steel blades for stage 6, just referred to, show a small amount of erosion on the inlet edge of the blades after 6,000 hours.

* The first five classes of turbines are apparently of German make.—Eds. Elec. Rev.

Turbines, Classes 4 and 5.—Three metals are in use, 5 per cent. nickel steel, brass, and bronze, arranged in the order given, starting from the H.P. end of the turbine. Steel is also used for the last three wheels in one case, and for the last two wheels in the other case, at the exhaust end. The metals appear to be in the correct position for the best results, and up to the present no trouble has been experienced.

Erosion of the inlet edge of the steel blades at the exhaust end of the machine is noticeable in all cases after 5,000 to 6,000 running hours; in the case of the compressor turbines (Class 5) running at 3,000 R.P.M., with a blade velocity of 720 ft. per second, the erosion is very pronounced, the edge of the blade being like a fine saw.

Auxiliary Turbines, Class 6.—These turbines have a Curtis wheel only, with four rows of blades. The first two rows of

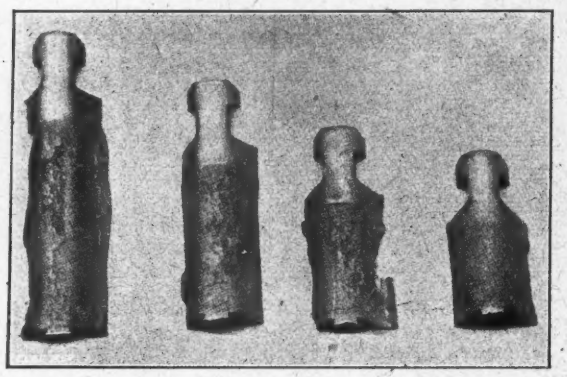


Fig. 3.

blades were of 5 per cent. nickel steel, which has given good results, and the last two rows were of aluminium bronze, and where the blade section was small this proved disastrous.

Fig. 6 shows typical examples of these blades, which would hardly be recognised as such, after 15,000 and 18,000 hours respectively.

On the later sets installed brass has given good results, being in good condition after 26,000 running hours.

Auxiliary Pump Turbines, Class 7.—This type has also a single Curtis wheel; in no case has the blade material shown deterioration, both steel and brass being in excellent condition after a maximum running period of 26,000 hours.

General.—From the foregoing remarks it is perfectly clear that aluminium bronze for use as a blade material in the high temperature stages of a turbine is totally unsuitable. While brass might do as well in the low temperature stages, one would not expect as long a life owing to the soft nature of the material.

Five per cent. nickel steel has given good service. Experience with brass blades covered 30,000 running hours, and no renewal owing to deterioriation has taken place; it is possible that it may outlast steel due to absence of oxidation.

Inlet Nozzles.—These are of cast-iron on all the turbines dealt with, and as supplied by the makers were quite un-

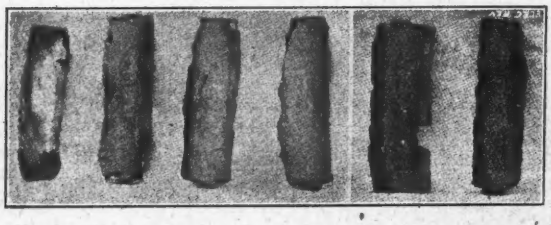


Fig. 4.

satisfactory. The nozzles are a series of ports divided by partitions, and the latter crack badly, large pieces breaking off and passing through the turbine, usually bruising the blades if no more. Blading troubles are not easy to locate, as a piece of metal frequently passes through several stages before becoming jammed.

Tests showed that the damaged nozzles did not reduce the efficiency, and accordingly a V-shaped portion was cut out of the partition before fitting the nozzles, which has practically cured this trouble.

As an experiment steel divisions forged from mild steel bar and cast into an iron body have been tried on a large turbine with very good results. Two small turbines with steel nozzles gave quite satisfactory results; bronze castings have been used by some makers; brass would probably be too soft.

Curtis Stationary Segments.—Four metals have been used as follows:—Aluminium bronze disintegrated rapidly owing to temperature; 25 per cent. nickel steel becomes brittle in time, and one breakage has occurred; 5 per cent. nickel steel is now used exclusively for all main turbine stationary segment blading, and stands up very well. Brass is sometimes used for the second row of the auxiliary turbines, and always for the third row; it stands well, the maximum hours in use so far being 30,673.

Guide Blading.—The material in general use is 30-32 per cent. nickel steel. The nature of the deterioration is the same in all cases, but the results, taken over a given period,

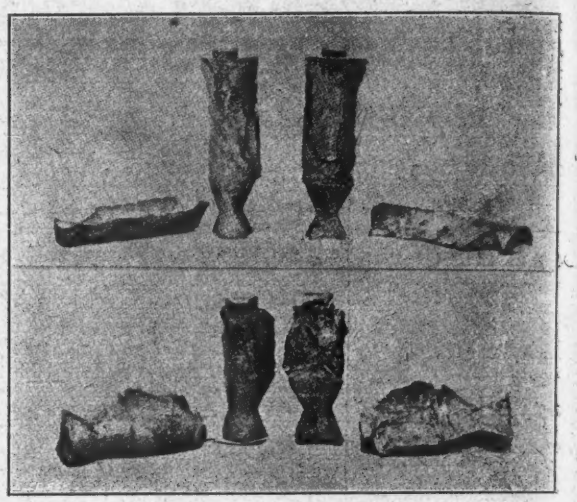


Fig. 5.

are quite inconsistent. The first visible indication appears in the form of a fine crack on the inlet side of the blade, and frequently close to the outer retaining ring, but sometimes near the centre of the blade. Before these cracks are actually visible, they can be produced by a few light hammer taps. These cracks extend over the surface of the blade, cobweb fashion, until pieces become detached, and pass through the succeeding stages, severely bruising and closing up the wheel blading on the inlet side, but seldom causing a strip. Ultimately, the whole of the blades crack, and if not attended to the guide ring collapses, causing heavy fouling and serious damage to the wheels and blading.

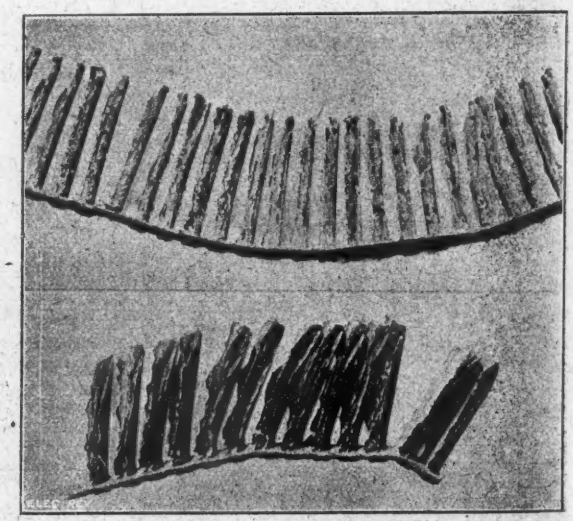


Fig. 6.

There is little danger when the cracks first appear, as several months elapse before pieces of guide blade break away. Examination at intervals of 3,000 hours allows one to follow the condition and judge when the ring should be renewed.

In the case of the guide blade diaphragms as fitted to Class 4 and 5 turbines, they become unsafe as soon as cracks appear, and movement of the diaphragms in the direction of the following wheel has taken place on different occasions. This tendency to displacement of the diaphragm is probably due to the circumferential pitch of the blades in the *guide blade diaphragm* construction being greater than in the *guide ring* construction, with a consequent increase of diaphragm area per blade.

Experience shows the great disparity in the running hours between the various stages at the same station, and the same stages at two different stations.

Influence of Material on Deterioration.—The evidence is hardly sufficient to state definitely the relative advantages of high or low percentage nickel steel, but the results obtained in No. 4 set, Rosherville, point to steel containing no nickel as being more suitable.

On the Class 4 turbines, steel, containing no nickel, has been supplied for some stages, and has so far shown no deterioration, while other stages, containing 30 per cent. nickel in the same machine have shown marked deterioration.

In the case of the guide ring renewed on No. 4 set, Vereeniging (stage 10), some of the blades were badly cracked, and others appeared to be in perfect condition; one of each was analysed, and both were found to be 30 per cent. nickel steel, the inference being that the presence of a high percentage of nickel does not necessarily cause the blades to crack.

Mechanical Stresses Imposed on the Blades by Expansion and Permanent Growth of the Retaining Rings and Diaphragms and by Sudden Changes of Temperature in the Blades.—We have ample evidence of the exceedingly heavy stress imposed on the blades from this cause, particularly at the high temperature end of the turbine.

When the machines were first erected, the guide rings were fitted to a groove in the casing, and secured thereto by means of screws; the C.I. diaphragm, of dished formation, is grooved round the periphery and fitted snug to the inner retaining ring of the guide ring, there being a corresponding tongue fitting the groove of the diaghragm to prevent lateral movement. The convex side of the diaphragm is toward the high pressure end of the machine, and is designed to resist the difference of pressure between the inlet and discharge side of the guide rings. It is found that the clearance between the diaphragm boss and the preceding wheel gradually diminishes. It, however, does not relieve the blades sufficiently to prevent severe buckling of the first two rings.

It is seldom the blades are *buckled* beyond the third guide ring, the expansion of the guide rings and diaphragms being naturally less as the temperature decreases, until at the exhaust end it is comparatively low, seldom exceeding 50 deg. C. If we assume heavy pressure on the blades to be the cause of the cracking, it seems strange that where the pressure is heaviest the blades are least affected. It may be a contributory cause, but in any case it is obviously better to relieve the blades of this stress as far as possible, and this has been accomplished in the case of the guide rings by machining a 3 mm. clearance between the guide ring and diaphragm and resting the diaphragm on two short fitting strips on the lower half. A few copper pins are fitted on the upper half of the guide ring, with about .5 mm. clearance between the pins and diaphragms, so that the latter cannot rise too much and foul the shaft gland. It is found that after a time these pins are crushed by the diaphragm, and they are eased periodically.

In the case of the guide blade diaphragms, these are suspended on lugs at each side of the turbine casing, 3 mm. clearance being left all round the casing groove, so that the diaphragm is free to move when fitted, but gradually tightens sideways in the groove as the growth of metal takes place.

In the case of the guide blade diaphragms on turbines, Classes 4 and 5, which were fitted to relieve blade stresses, 1 mm. clearance was left round the circumference by the erectors. This was absorbed during the first year of running, and, in addition, in some cases, very heavy distortion has taken place.

We have cases on record where long life has been attained without the rings being eased at all. On one of the 3,000-kw. sets installed at Brakpan some of the blading was renewed after 46,890 hours (stages 2, 6, 7), and on the adjoining set the blading was eased after over 40,000 hours, and is still in commission and in good condition after 59,000 hours, with the exception of the guide ring for stage 2, the blades of which are now cracking. In both machines the blades are of 30 per cent. nickel steel. Some makers use steel castings for turbine diaphragms, and this material is not subject to permanent growth like cast iron.

With regard to the sudden expansion of the blades themselves when starting up a set from a cold state, the blades are thin and will temporarily attain a higher temperature than the retaining rings; they will be subjected to compression stresses on this account, although 30 per cent. nickel steel probably has a very low coefficient of expansion. 36 per cent. nickel steel (Invar), used for instrument work, has no coefficient of expansion.

In this connection, the number of starts over an extended period have been examined on the various 9,600-kw. sets, but this does not seem to have any bearing on the life of the blades, and it is probable that these stresses are not so serious as others which the blades are called upon to withstand.

It having been decided to cast these guide blade rings locally, their manufacture presented some difficulty at first. Ordinary steel plate, 2 and 3 mm. thick, was used, cut to shape and bent round a former. The blades were then flanged and riveted between the retaining rings, a fairly neat job being made. It is significant that the turbine in which these re-bladed rings are fitted is less efficient than the others of similar type. This may be due to the rivet heads and flanged portion of the blades, which project into the steam passage and obstruct the steam flow.

Other Stresses, Vibration, Impurities in the Steam, &c.—If we assume the drop in pressure across each diaphragm to be 6 lb. per sq. in., and the diameter of the diaphragm to be 60 in., the guide blades have to withstand a lateral force of 8.4 tons, which divided between the blades may not be excessive. A certain amount of vibration will take place, due to the rotation of the parts, and passage of steam through the blading. This vibration acting on the guide blades while under stress from the diaphragm pressure, and perhaps at a critical temperature, may cause cracks to develop and ultimately break down the material. Another factor is impurities carried over from the boilers with the steam. For instance, on the 3,000 sets at Brakpan, where exceptionally long life has been attained, oil occurs as a greasy deposit on the guide blades, and may have acted as a protective covering.

(To be concluded.)

SOME POINTS IN CONNECTION WITH ENGINEERING SPECIFICATIONS.

The paper by Mr. J. Shepherd was read and discussed at a meeting of the Scottish Local Section of the Institution of Electrical Engineers at Glasgow.

Mr. Arch. Page (Glasgow) agreed with the author that in the majority of cases there was great need for engineers to specify thoroughly and exactly what they wanted when purchasing, and he cited instances to show that if a standard apparatus was bought the purchaser was sometimes left with undesirable features. He particularly instanced the necessity for having steel fittings with a standard turbine on the high-pressure side for the superheated steam they had now to deal with. It was criminal to use anything but steel. On the condenser question, if they did not specify the friction drop from the condenser they might get pumping plant which would take twice the power necessary, while, as to starting gear, if they did not distinctly specify the fittings wanted they would probably get the ordinary brass-finisher's product, which would be unsuitable. Mr. Shepherd had advanced points to be included in a specification as general conditions, detailed technical requirements, and bills of quantities. Another very important heading was technical data, which ought to be supplied by the contractor, and asked for in the specification, because otherwise they would probably require to spend a day with the contractor's representative before they had any proper idea of what was being submitted. General conditions had been a very thorny subject for several years, and in the I.E.E. General Conditions, which Mr. Shepherd suggested should be more or less accepted, there were some points which required consideration. For instance, it was said that the testing should be done by the manufacturer; the purchaser was not at all likely to accept a piece of apparatus which had been tested by the manufacturer only. Another point related to solicitors or town clerks drawing up general conditions; in Mr. Page's opinion it would be better for the engineer to draft the specifications first, and then give the legal experts their turn at improving matters. There appeared to be some contradiction in the suggestion that the lowest offer should be accepted on a clear and concise specification, and that the results would be generally satisfactory, if the engineer was allowed to select a firm of known excellence and ripe experience.

Mr. Shepherd explained that his point was that if the engineer was allowed to select a well-known firm of ripe experience there would be little doubt of the excellence of the plant, though they might take it as a general rule that the tender usually accepted was the lowest.

Mr. Page proceeded to deal with the coal specification, pointing out that the method which had worked all right in his experience was to buy from pits from which they were in the habit of purchasing—the pits extending over large areas, and the engineer making tests over considerable periods. The contractor was usually left in the dark as to what was considered the value of the coal. When the tenders were received the calorific values were tested and compared with the calorific values of the previous tests, and the orders were placed accordingly. He disagreed with Mr. Shepherd that the duct system of cable laying was the best. Nowadays the procedure was not to work through a nest of ducts, but to carry cables along routes around which they were likely to pick up business.

Mr. E. Seddon (Edinburgh) said it seemed very necessary for every engineer to define clearly the conditions and results he wished to obtain with the plant, but to try and design the respective parts would hinder engineering generally. It was folly for the purchaser to be too definite in detail in specifications, because then the manufacturer did not get a fair chance to experiment with his own particular kind of apparatus. As to heat transformation, there was a wide field open

for the fuel engineer to secure a greater efficiency in the relation of coal to the output from the generator. He agreed with Mr. Page that if the colliery proprietors would not conform to the practice of selling by B.TH.U.'s the purchaser had simply to get the values of the coals from each particular pit. He hoped the colliery owners, however, would see the reasonableness of selling on the B.TH.U. basis.

Mr. MORGAN (Glasgow) gave it as his experience that it was better to get coals from adjacent pits and strike the relative values between the different collieries. The coal which had the highest calorific value might not necessarily suit them best.

Mr. M'LEOD (Glasgow) thought it was an extraordinary thing that, while most engineers recognised the importance of drawing up a sharply worded specification for capital plant, there were too few who took the trouble to extend the system to cover consumable stores. Very often the purchaser of consumable stores was left with some non-technical clerk who might allow himself to be led away by a plausible traveller into purchasing an unsuitable oil for use in turbines which might lead to the ultimate wrecking of the plant. Sometimes specifications were purposely left vague, and some local authorities had reason to regret signing free wiring contracts which were sometimes drawn up in a very crude way. Many engineers in this country had been influenced by the supposed economy effected by using small coal. One could understand that attitude being taken some years ago, when the colliery owners were pleased to get rid of this material at 5s. or 6s. a ton, but at the present price of 15s. it was not worth it. Greater economy could be effected by purchasing large coal and crushing it suitably for their grates. He suggested in cable laying the use of armoured cables laid direct in the ground as economical, particularly in rural districts, where transport was scarce and expensive.

Mr. J. M. MUNRO (Glasgow) argued that every specification, no matter how carefully prepared, provided openings for the contractor, who was at least as clever a man as the engineer, who desired, and perhaps was rather compelled, to find some way of escape from the position in which he found himself. In the end, client and contractor alike must trust the engineer. The "lowest tender" was a fetish before which local authorities had bowed for years, and it had much superficially to recommend it; but, after all, it was an insufficient, insecure and shallow defence, and one of the benefits in having a competent engineer was that they could come out into the open and accept any tender. Whatever any large number of consulting engineers might ask for, they should not cease to contend for a big measure of freedom when the choice of tender, not necessarily the cheapest, came to be decided. In one case, out of nine or ten tenders he got for a generator, he accepted the dearest of the lot. He also supported the purchase of coal by the B.TH.U. principle as being the only sensible and practical one.

In his reply, Mr. SHEPHERD said he would go further than Mr. Page, and say it was criminal to use cast-iron for superheated steam for anything over 500 deg. for permanent work. He agreed that it was very necessary to go into details in specifying turbo-generators. In the supply of motor starters there appeared nothing more iniquitous than the action of some contractors, who seemed to see how cheaply they could manufacture their apparatus without much regard to design, fitness, or robustness. He agreed with Mr. Page that transformers and other plant might be perfectly suitable when placed in small power systems, but when placed in large systems, with unlimited power behind them, such plant utterly failed, hence the necessity of detailed specifications. In his opinion, it was necessary to specify with some detail, so that they could accept the lowest tender with some degree of comfort. He agreed with Mr. Seddon that it was better to buy coal direct if they could get the mineral of a fixed value, but if they compared deliveries from the *same* colliery for the *same year* they would get anything but uniform value. He submitted the following figures in this connection actually obtained from analysis:—Highest moisture, 14.1 per cent.; lowest, 9.5 per cent; highest small, 32.4 per cent.; lowest, 13.5 per cent.; highest calorific value, 13,500 B.TH.U.'s; and lowest, 12,294 B.TH.U.'s. If engineers were going to buy their raw material at fixed prices, and varying so much in value, they were not buying economically. From his general experience, the accepting of the lowest tender was a course which had seldom ended in difficulties when tendering to a proper specification. The question of how varying tenders and varying qualities of coal could be adjusted was answered if they put in the specification for coal of standard value, and that standard value a calorific value, of, say, 12,500 B.TH.U., moisture 9 per cent., small 20 per cent., ash 10 per cent. They could then arrive at a point when they could say which particular coal was the cheapest. Sampling was an easy matter, and he never knew of a case where a contractor asked for an independent analysis during 10 years' buying by this method.

Birmingham Electricity Department.—FEMALE LABOUR.—The Electricity Supply Committee has decided to employ women in the power stations, particularly in the switch-rooms and engine and boiler houses.

NEW PATENTS APPLIED FOR, 1917.

(NOT YET PUBLISHED).

Compiled expressly for this journal by MESSRS. W. P. THOMPSON & CO., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford.

5,315. "Sparking plugs for internal-combustion engines." A. G. FRANCE. April 16th.

5,333. "Wireless receiving circuits." A. J. MARTIN. April 16th.

5,349. "Electric lamps." L. W. COX. April 16th.

5,354. "Construction and manufacture of electric incandescent lamps, caps, and sockets." K. SASSULIEZ. April 16th.

5,358. "Electrical insulators." BULLERS, LTD., & G. V. TWISS. April 16th.

5,363. "Audion or lamp relay or amplifying apparatus for wireless telegraphy and telephony." M. LATOUR. April 16th. (France, April 15th, 1916.)

5,365. "Thermostatic apparatus, especially applicable as relays and circuit interrupters." E. A. GRAHAM & W. J. RICKETS. April 16th.

5,401. "Transformers for alternating electric currents." O. LORAS. April 17th. (France, June 9th, 1916.)

5,410. "Electric heating of metallic bodies for forging, &c." D. F. CAMPBELL. April 17th.

5,411. "Magneto or dynamo-electric machines." SOC. ANON. DE MAGNETOS ET APPAREILS ELECTRIQUES SAMA. April 17th. (France, May 17th, 1916.)

5,412. "Electric contact-breaker." SOC. ANON. DE MAGNETOS ET APPAREILS ELECTRIQUES SAMA. April 17th. (France, May 26th, 1916.)

5,413. "Storage batteries." SIR C. S. FORBES. April 17th.

5,431. "Plug for telephone switchboards, &c." P. P. CRAVEN. April 18th.

5,448. "Manufacture of metallic tungsten and its alloys." O. J. STANNARD. April 18th.

5,451. "Protective devices for electric apparatus." BRITISH THOMSON-HOUSTON CO. (General Electric Co., U.S.A.). April 18th.

5,481. "Sparking devices." F. J. TURQUAND. April 19th.

5,482. "Sparking plugs." B. D. HOWARTH. April 19th.

5,494. "Constant-current motor and dynamo without commutator." M. C. TIARKS. April 19th.

5,503. "X-ray tube, stand, and table." E. E. GREVILLE. April 19th.

5,519 "Wireless signalling systems." BRITISH THOMSON-HOUSTON CO. (General Electric Co., U.S.A.). April 19th.

5,528. "Electric lamps." S. YUYAMA. April 19th. (U.S.A., April 19th, 1916.)

5,576. "Spark control in combustion engines." J. G. HEASLET. April 20th.

5,588. "Ignition system and starting apparatus for internal-combustion engines." G. DOLCE. April 20th. (Italy, July 4th, 1916.)

5,617. "Ignition magnetos for internal-combustion engines." E. MALIVERT. April 21st. (France, April 28th, 1916.)

5,632. "Process for electrolytic deposition of metals." N. H. M. DEKKER. April 21st.

PUBLISHED SPECIFICATIONS.

1916.

The numbers in parentheses are those under which the specification will be printed and abridged, and all subsequent proceedings will be taken.

4,104. ROUTE INDICATING AND SIGNALLING DEVICES FOR USE ON RAILWAYS AND THE LIKE. R. G. Berry & H. W. Moore. March 20th, 1916. (104,902.)

4,138. RADIO LUMINOUS SIGHTS. G. Panerai. March 20th, 1916. (Patent of addition not granted.) (104,905.)

4,177. INDICATOR OR SIGNALLING APPARATUS FOR INDICATING THE TURNING OF MOTOR VEHICLES. H. O. Faulkner. March 21st, 1916. (104,908.)

4,275. BURGLAR ALARM SYSTEMS. C. A. Carpenter. March 22nd, 1916. (104,918.)

4,351. LAMPS. Quarx-Lampen Ges. February 12th, 1915. (100,267.)

9,667. MOTOR PLOUGHS, CULTIVATING IMPLEMENTS, CABLE-LAYING MACHINES, AND THE LIKE. W. E. Martin. July 8th, 1916. (105,000.)

2,861. RECEIVERS FOR WIRELESS SIGNALS. Marconi's Wireless Telegraph Co. & F. P. Swan. February 25th, 1916. (105,081.)

4,407. TELEGRAPHY. Muirhead & Co. and G. O. Squier. March 24th, 1916. (105,089.)

4,596. PORTABLE ELECTRIC BATTERY LAMPS. H. F. Joel. March 29th, 1916 (105,100.)

4,629. ELECTRIC IGNITION OF EXPLOSIVES. R. Miller. March 29th, 1916. (105,104.)

4,703. THERMOSTATIC CIRCUIT-BREAKING APPARATUS FOR ELECTRIC HEATERS. J. E. Harvey. April 3rd, 1915. (100,252.)

5,104. ENCLOSURE FOR SWITCHGEAR. A. H. Curtis & Igranic Electric Co. April 6th, 1916. (105,124.)

6,121. PROCESS AND APPARATUS FOR EFFECTING CHEMICAL REACTIONS BY MEANS OF ELECTRIC ARCS. A. V. Lipinski. April 28th, 1916. (105,135.)

9,020. DYNAMO-ELECTRIC MACHINES. Crompton & Co. and N. Pensabene. June 27th, 1916. (105,165.)

10,920. MAGNETO-ELECTRIC MACHINES. F. R. Simms. August 2nd, 1916. (105,180.)

10,939. ELECTRIC MOTOR-STARTING SWITCHES OR CONTROLLERS. F. Newton and Newton Bros. (Derby), Ltd. August 2nd, 1916. (105,181.)

11,240. MEANS FOR CONNECTING PIPES, ELECTRICAL CONDUITS, AND THE LIKE. F. W. Uren. August 9th, 1916. (105,182.)

14,767. VAPOUR ELECTRIC SYSTEMS FOR CONVERSION OF DIRECT ELECTRIC CURRENTS INTO ALTERNATING CURRENTS. British Westinghouse Electric and Manufacturing Co. November 29th, 1915. (102,484.)

Electrically-Propelled Battle Cruisers.—The U.S. Navy Department has decided to build five battle cruisers with electrical propulsion machinery. The vessels will cost about $76,000,000 for hulls and machinery. There will be another expense of about $5,337,810 for arms and armament on each ship. These will be the first battle cruisers built by the United States, and the first equipped with electric propulsion, although the collier Jupiter, electrically driven, was built by the United States some time ago, and has proved a great success from a naval viewpoint. The details of the electrical machinery have not yet been worked out; several months' time will be needed for this work. The generators will be driven by steam turbines. Four new battleships are also to be equipped with electric drive.—*Electrical World.*